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Padilla Bay Freshwater Tributaries Fecal Coliform Bacteria Total Maximum Daily Load Report

Water Quality Improvement Report and Implementation Plan

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Padilla Bay Tributaries Fecal Coliform Bacteria Total Maximum Daily Load Report

Water Quality Improvement Report

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Environmental Assessment Program and Water Quality Program

Washington State Department of Ecology

Olympia, Washington

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Contents

Figures

Tables

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Chapter 1: Introduction

Clean water is essential for the safety and health of people as well as the many living organisms that depend on the water for their home. Current and historical water quality data collected in the Padilla Bay watershed show that fecal coliform bacteria levels are too high.

Fecal coliform (FC) is a type of bacteria common in the digestive tract and feces of humans and other warm-blooded animals. These bacteria themselves are not pathogenic but are of concern because they may indicate the presence of other pathogens and diseases that make people sick. As the level of fecal coliform increases, the risk of people getting sick from interacting with water, or eating food exposed to it, also increases. Bacteria can get into our waters from improperly functioning septic systems, contaminated stormwater, livestock and agricultural lands, and feces from pets and wildlife.

Figure 1 - Padilla Bay Tributary Little Indian Slough

Reducing the amount of bacteria getting into sloughs and tributaries will keep the area safer for people and animals, as well as protect the tributary watercourses for the designated uses. The goal of this report is to ensure that inland waters in the Padilla Bay freshwater tributaries attain Washington State water quality standards for FC.

This Water Quality Improvement Report (WQIR) includes the results of a study to determine the areas of highest concern. The total amount of allowable FC loading to the Padilla Bay freshwater tributaries watershed, known as a Total Maximum Daily Load or “TMDL”, is calculated along with the necessary reductions needed in order to meet Washington State standards. Chapter 3, the Water Quality Implementation Plan (WQIP).

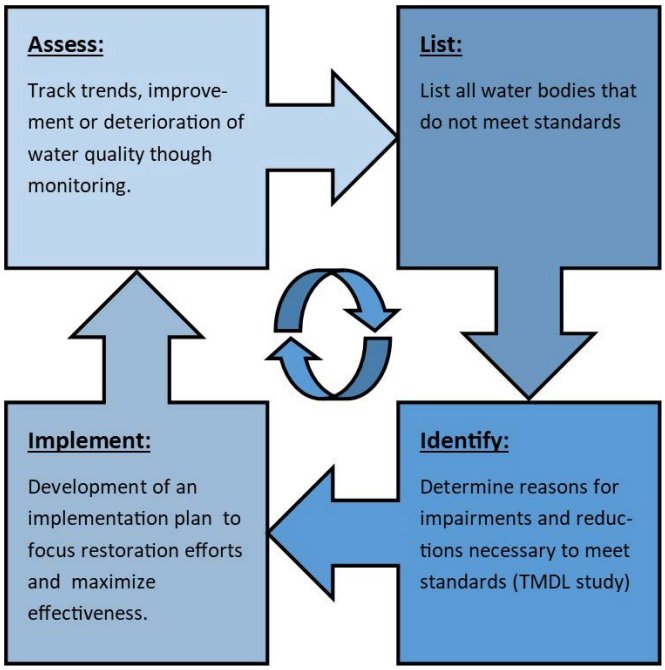


Figure 2 - TMDL development cycle

The Department of Ecology (Ecology) will work with multiple conservation organizations, including but not limited to, Skagit County Public Works, Skagit Conservation District, Skagit Natural Resources Department, Skagit County Planning and Development Services, Washington Department of Agriculture, local stakeholders and conservation organizations and local and state health officials, to put the implementation plan into action (Figure 2). Ecology and partners will work closely with the community and interested participants to track down bacteria sources and develop realistic solutions to reduce bacteria loading to the freshwater sloughs and, in turn, Padilla Bay.

More information on the TMDL program and the technical details of this TMDL study can be found in Appendix A.

Overview

The Padilla Bay watershed is a part of the Skagit River delta and is located in the northwest section of Skagit County in Washington State in the water resource inventory area (WRIA) 3 (Figure 3). The bay itself is eight miles long (north and south) and three miles wide (east to west).

The eastern portion of the Padilla Bay watershed has experienced extensive diking, drainage, and clearing to make it suitable for settlement and agricultural development. The construction of dikes has limited the ability of streams and water courses to alter their paths over time and access the traditional floodplain. Agricultural production is a significant economic driver for Skagit County, accounting for a significant portion of the county's economic output. The U.S.

Department of Agriculture (USDA) Census from 2012 estimates that Skagit County farmers produced about $300 million worth of crops, livestock, and dairy products on approximately 90,000 acres of land.

The Eastern Padilla Bay watershed consists of four major sloughs and two agricultural areas at the northern and southern ends of the bay. The major sloughs, No Name Slough, Big Indian Slough, Little Indian Slough, and Joe Leary Slough drain roughly 9,300 ha (22,980 acres). There are also many interconnected ditches and drainages associated with water management and agriculture production that flow into the sloughs (Figure 3). Higgins Slough, as well as a network of drainage north of Joe Leary Slough are within the watershed, but were not monitored as a part of this study. The watershed is relatively flat with high water tables that make drainage and water management a challenge for many people in the communities of the Padilla Bay watershed.

Skagit County in general has experienced significant population growth, with more than a 47 percent increase between 1990 and 2010, and an additional 6 percent from 2010 to 2017 (U.S. Census Bureau, 2019). This increase has led to additional development pressure throughout the county and watershed. Skagit County Public Works and Skagit County Environmental Health Department are actively working to reduce existing and potential water quality impacts through land use planning, code updates and enforcement, implementation of best management practices, water quality monitoring, and active communication with the public regarding water quality issues.

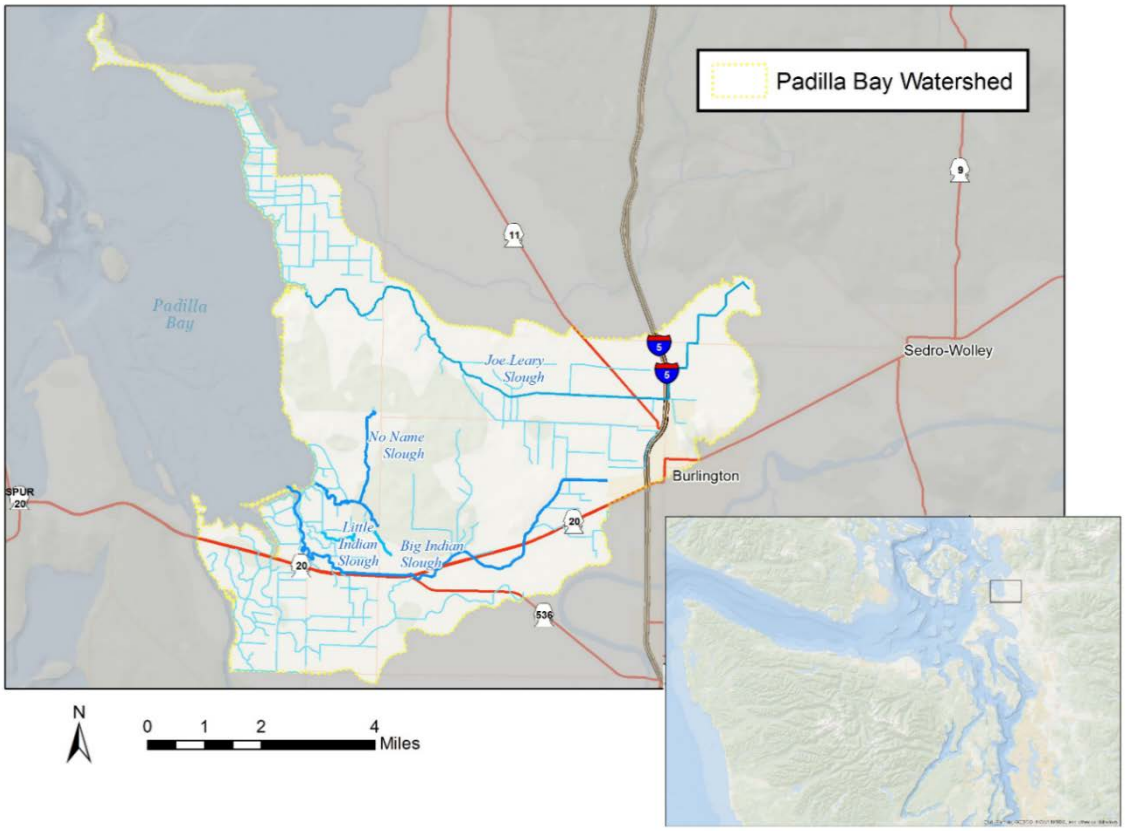


Figure 3 - Eastern Padilla Bay watershed area. The TMDL consists of four major drainage areas: Joe Leary Slough, No Name Slough, Little Indian Slough, and Big Indian Slough, shown in the dark blue lines.

While there are no tribal lands within the border of the TMDL area, impacts from upstream land use and pollutant loadings can have a negative effect on the tribal usual and accustomed areas. Water pollution in the freshwater watershed can decrease water quality in the marine environment, impacting fisheries and closing shellfish beds. These downstream impacts demonstrate a vested interest to the water quality and implementation efforts of the Tribes in the region, such as the Swinomish Indian Tribal Community, the Upper Skagit Indian Tribe, the Lummi Nation, and the Samish Indian Nation.

Climate

The Padilla Bay watershed has a temperate climate with mild summers and moderate wet winters. The period from November through January has the most precipitation and the watershed receives an average annual precipitation of 33 inches. The heavy rains often saturate the poorly draining soils in the lower elevation lands, causing drainage issues for agriculture. About 75 percent of the annual average precipitation occurs from October to April.

The timing, frequency, duration, and intensity of rain events can affect water quality. Historically, rainfall is light to moderate intensity and continuous from October to April, rather

than brief heavy rainfall. The driest months of the year are July and August. Historical averages of total precipitation are included in Figure 4.

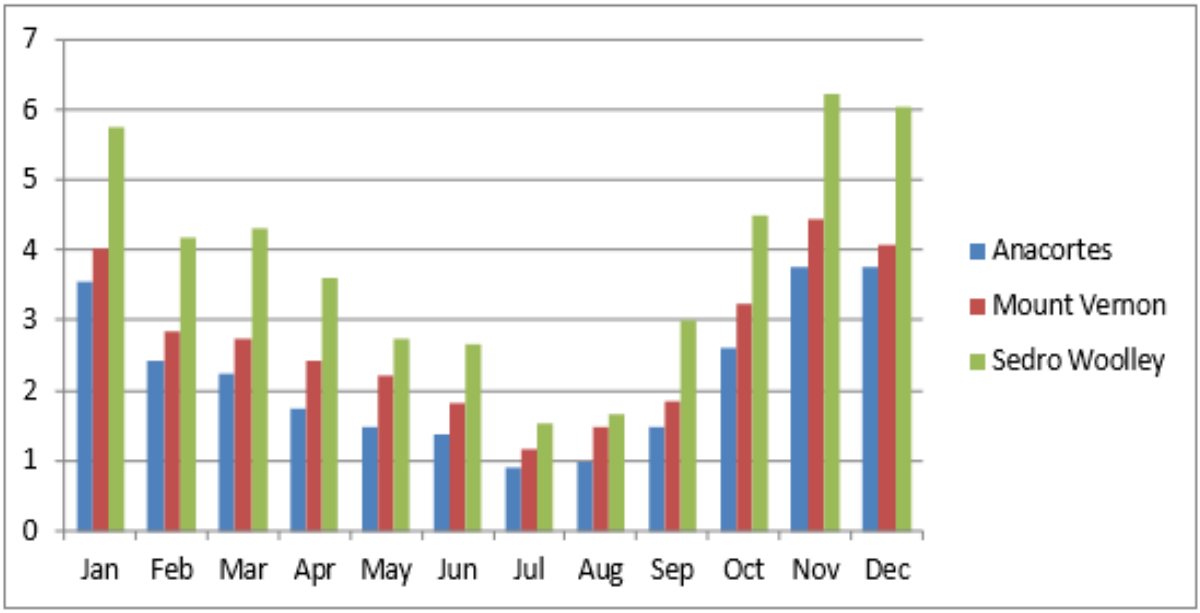


Figure 4 - Average total precipitation (inches) for three WSU weather stations near the Padilla Bay watershed: Anacortes (450176), Mount Vernon (455678), and Sedro-Woolley (457507) (1931-2005).

Natural Resources of the Padilla Bay Watershed

Padilla Bay is one of 28 reserves in the National Estuary Research Reserve (NERR) program. The Reserve's 11,996 acres are used for research, monitoring, and teaching visitors and students about the importance of conservation and protection of natural places. Each year, local families and tourists visit the Padilla Bay Reserve and Bay View State Park, with more than 10,000 grade school children visiting the bay annually. For the beneficial uses and local enjoyment of Padilla Bay to be preserved, the tributaries and marine waters must meet water quality standards.

The sheltered bays and sloughs of this watershed provide critical wintering and migratory areas for seabirds, ducks, and geese. The Audubon Society estimates that Padilla Bay provides wintering and migratory habitat for 20,000 shorebirds (National Audubon Society, 2013). Eelgrass (Figure 5) is important to large numbers of dabbling ducks during the winter (Jeffrey, 1976) along with Brant, *Branta bernicla*, which overwinter with other waterfowl in the bay feeding on the eelgrass. Skagit County is also host to one of the highest concentrations of wintering raptors in North America (National Audubon Society, 2013). Many diverse raptor species use farmland and flatlands around Padilla Bay as their native habitat.

Figure 5 - Eel grass in Padilla Bay

Scope

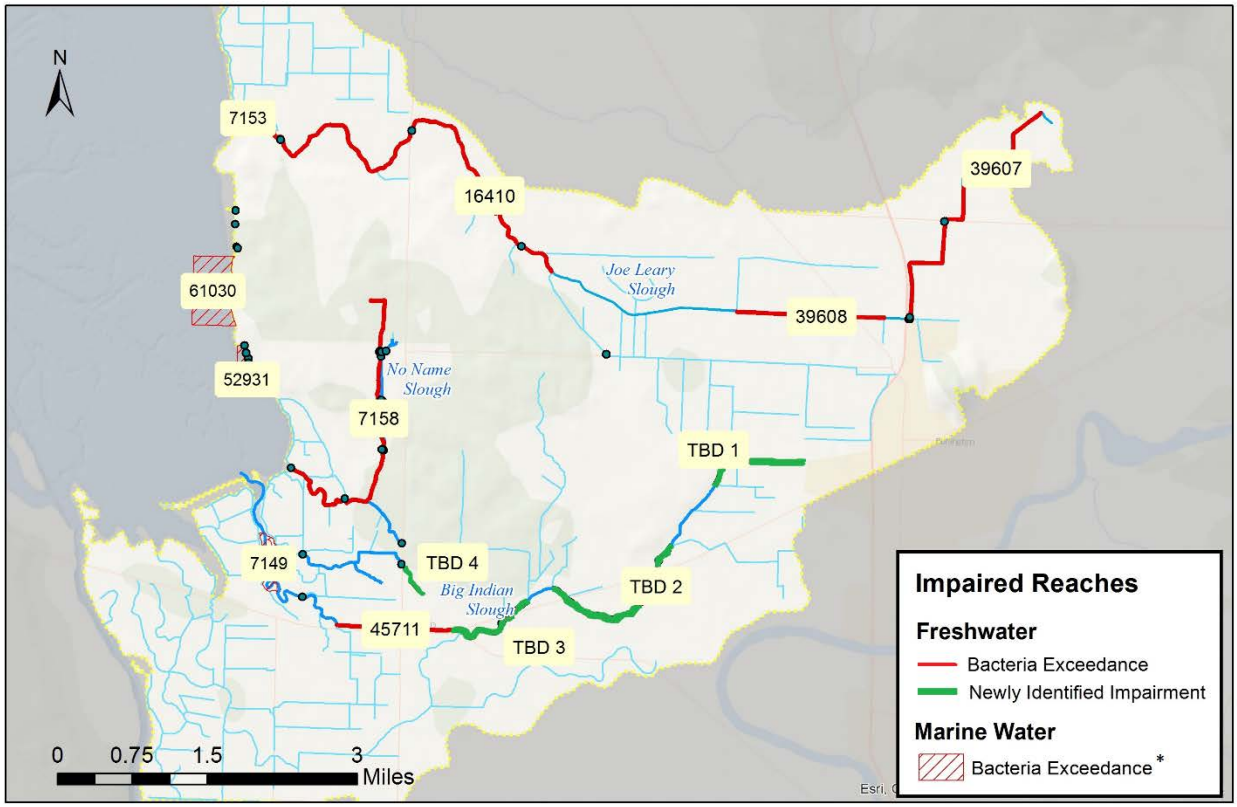
Based on all available water quality data, the following waterbodies (or segments of waterbodies) found in Table 1 and Table 2 and displayed in Figure 6 do not meet the water quality standards for bacteria. This TMDL does not address any marine listings, as each impaired reach is a freshwater 303(d) listing. While the tributaries account for less the than 1% of the total daily exchange of water within Padilla Bay (Bulthuis, 2013) reductions of bacteria in the tributaries may benefit Padilla Bay by reducing total loading to the marine waters.

Table 1 – 2012 303(d) Impaired waterbodies addressed by this TMDL.

Listing ID	Waterbody Name	Pollutant	Medium	Reach Code (Assessment Unit ID)
45711	Big Indian Slough	Bacteria	Freshwater	17110002000331
7158	No Name Slough	Bacteria	Freshwater	17110002000314
39608	Joe Leary Slough	Bacteria	Freshwater	17110002001748
39607	Joe Leary Slough	Bacteria	Freshwater	17110002000523
16410	Joe Leary Slough	Bacteria	Freshwater	17110002000031

Table 2 – Identified Impairments without current Listing IDs addressed by this TMDL

Basis Statement	Waterbody Name/Site name	Pollutant	Medium	Reach Code (Assessment Unit ID)
3 of 19 (16%) of samples collected exceed the percent criterion (200 col/100mL)	Big Indian Slough/ BI8.2	Bacteria	Freshwater	17110002000720
5 of 21 (24%) of samples collected exceed the percent criterion (200 col/100mL)	Big Indian Slough/ BI6.2	Bacteria	Freshwater	17110002001375
5 of 21 (24%) of samples collected exceed the percent criterion (200 col/100mL)	Big Indian Slough/ BI6.2	Bacteria	Freshwater	17110002001367
A geometric mean of 212 col/100mL calculated from 18 samples collected exceeds the geometric mean criterion (100 col/100mL)	Little Indian Slough / LI1.9	Bacteria	Freshwater	17110002000687



*Marine listings are not addessed in this TMDL

Figure 6 - Map of current (2012) 303(d) listings for bacteria impairment in Eastern Padilla Bay watershed. Additional reaches identified as impaired through the TMDL watershed assessment are included as green line.

There are other 303(d) listed impairments in the watershed, such as pH, dissolved oxygen, and temperature. While this TMDL does not directly address these impairments, many of the recommended BMP practices have multiple benefits, which may indirectly address these additional impairments. Increased water retention and/or treatment will reduce sediment and nutrient loading, improve water quality, and assist in future delisting efforts.

Uses of Waterbodies

The federal Clean Water Act requires that states develop water quality standards for all rivers, lakes, and marine waters to ensure public safety, sustain public health and enjoyment of surface waters, and to propagate and protect fish, shellfish, and wildlife. All state standards must meet minimum federal requirements, and are subject to local, state, and federal review and comment before they are approved. Water quality must then be assessed through local monitoring efforts to determine if the water meets the established standards.

Ecology evaluates all available water quality data as part of its Water Quality Assessment (WQA). To develop the WQA, Ecology compiles its own water quality data along with data

submitted by local, state, and federal governments, tribes, industries, and citizen monitoring groups. All data used in this WQA must be collected using appropriate scientific methods before they are used to determine compliance with state standards. Ecology's guidelines for assessing data and categorizing waterbodies are discussed in detail in WQ Policy 1-11.[1] The WQA divides water bodies into five categories:

Category 1 – Meets standards for parameter(s) for which it has been tested.
Category 2 – Waters of concern.
Category 3 – Waters with no data or insufficient data available.
Category 4 – Polluted waters that do not require a TMDL because:
4a – Have an approved TMDL being implemented.
4b – Have a pollution control program in place that should solve the problem.
4c – Are impaired by a non-pollutant such as low water flow, dams, culverts.
Category 5 – Polluted waters that require a TMDL – the 303(d) list.

Waters whose beneficial uses (such as, drinking, recreation, aquatic habitat, or industrial uses) are impaired are placed in the polluted water category (Category 5). Ecology's most current list of Category 5 waters shows six impaired freshwater segments (45711, 7153, 7158, 39608, 39607, and 16410) in the Padilla Bay watershed (Figure 6). Four additional bacteria impaired reaches were identified during the TMDL assessment, and loading and reduction values are included in this TMDL. Theses reaches are included in the impaired reaches table, but do not have listing ID numbers.

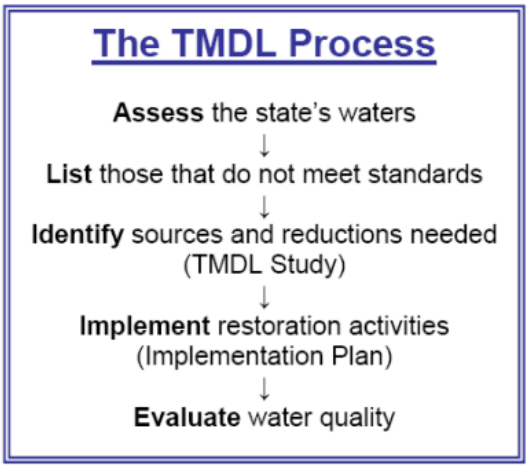


Figure 7 - TMDL process

The 303(d) list is prepared in compliance with the provisions of Section 303(d) of the Clean Water Act which requires polluted waters to be identified. Once a water is determined to be impaired and placed on the 303(d) list, a TMDL is required.

[1] https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-improvement/Assessment-of-state-waters-303d/Assessment-policy-1-11

A TMDL study quantifies pollution problems in the watershed and then specifies how much pollution needs to be reduced or eliminated to achieve clean water. Ecology then works with the local community to develop an overall approach to reduce and control the pollutant(s) of concern.

This TMDL will be submitted to the U.S. Environmental Protection Agency (EPA) for review and approval. This TMDL document includes both the scientific examination of the pollution problem and a plan to return local waters to good health. This report includes both general and specific implementation plans and commitments to improve water quality, as well as potential funding sources to facilitate implementation (Figure 7).

Water Quality Criteria

Ecology is responsible for developing and implementing water quality standards for surface waters in Washington. The standards are developed using guidance from state and federal programs and existing scientific information to establish numeric and narrative criteria as well as designate beneficial uses for different water bodies. Water quality standards are designed to protect public health and public enjoyment of state waters as well as the propagation and protection of fish, shellfish, and wildlife.

The freshwater creeks and sloughs in the Padilla Bay watershed must be available for “primary contact recreation.” Primary contact recreation means human exposure of the eyes, ears, nose, and throat to water may occur. Since children are the most sensitive group to many of the waterborne pathogens of concern, even shallow waters may warrant primary contact protection.

Local waters are in compliance with state standards when they do not exceed both the geometric mean criterion and the statistical threshold value (i.e., no more than ten percent of all samples exceed that value) (Table 3). The units of bacteria are measured in “colony forming units” or (cfu), based on the number of viable cells within the sample when they are tested in a laboratory.

Table 3 - Washington State Water Quality Standards for fecal coliform bacteria in freshwater.

Freshwater Standard	Geometric mean (cfu/100 mL)	Statistical threshold value (cfu/100 mL)
Padilla Bay freshwater tributaries	100	200

When either criterion is exceeded, practices throughout the watershed need to be evaluated to determine what is causing the issue, and what steps can be taken that will bring bacteria concentrations back down to acceptable levels.

While conducting this study, additional watercourse segments were sampled to determine potential sources within the watershed. Portions of Little Indian and Big Indian sloughs were evaluated during both the wet and dry periods to determine the seasonal loading.

Several of the samples exceeded the water quality standards. While they are not included on the current 303(d) list, they are impaired by excessive bacteria levels and thus discussed and addressed in this plan.

The standards also must include an anti-degradation policy that requires maintaining existing uses and protecting water bodies to a higher quality than what numeric criteria require. The water quality standards are subject to public comment and review, and once approved at a state and federal level, are published in Washington Administration Code (WAC) Chapter 173-201A.

Ecology's anti-degradation policy (WAC 173-201A-300) protects existing water quality and beneficial uses. The purpose of the anti-degradation policy is to:

- Restore and maintain the highest possible quality of the surface waters of Washington;
- Describe situations under which water quality may be lowered from its current condition;
- Apply to human activities that are likely to have an impact on the water quality of a surface water;
- Ensure that all human activities that are likely to contribute to a lowering of water quality, at a minimum, apply all known, available, and reasonable methods of prevention, control, and treatment (AKART); and
- Apply three levels of protection for surface waters of the state:
- Tier I - used to ensure existing and designated uses are maintained and protected and applies to all waters and all sources of pollution.
- Tier II - used to ensure that waters of a higher quality than the criteria assigned in this chapter are not degraded unless such lowering of water quality is necessary and in the overriding public interest. Tier II applies only to a specific list of polluting activities.
- Tier III - used to prevent the degradation of waters formally listed as "outstanding resource waters," and applies to all sources of pollution.

In January 2019, the Washington State Department of Ecology (Ecology) adopted amendments to Chapter 173-201A WAC, Water Quality Standards for Surface Waters of Washington State. This rulemaking updated freshwater quality standards for the protection of water contact recreational uses in state waters. It adopted (1) Escherichia coli (*E. coli*) as the new bacterial indicator in freshwater, in place of FC, and (2) new numeric criteria to protect water contact recreational uses.

Data collection and analysis for this TMDL used fecal coliform to assess compliance with Water Quality Standards and were completed prior to the rulemaking. The Rule Implementation Plan (Ecology, 2019) allows for the option of using the FC indicator before the transition period ends on December 31, 2020.

This TMDL report uses this option with the expectation that the fecal coliform load reductions and implementation plan will protect downstream beneficial uses and address both *E. coli* and fecal coliform bacteria sources.

If a TMDL is written for both recreational and shellfish harvesting uses, the recreational use will need to meet the updated criteria starting in 2021 (Ecology, 2019). To meet both uses, dual monitoring can be done to determine the attainment of each use (recreation and shellfish) or the facility may wait for effectiveness monitoring to occur using *E. coli*. Samples collected during effectiveness monitoring may be analyzed for *E. coli* and compared with water quality standards during the water quality assessment to determine attainment of the recreational use.

While *E. coli* will be used to determine future attainment of the recreational use in freshwaters, including the freshwater tributaries of Padilla Bay, FC will continue to be used to determine attainment of the shellfish harvesting use in marine waters. It is recommended that *E. coli* be used to evaluate water quality in the tributaries, with dual monitoring of *E. coli* and FC bacteria at the outlet of each tributary. The marine water quality standards for shellfish harvesting are:

> *FC organism levels must not exceed a geometric mean value of 14 colonies/100 mL, with not more than 10% of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 43 colonies/100 mL.* [WAC 173-201A-210(3) (b)]

Escherichia coli (*E. coli*) samples were collected at a subset of fixed-network sites throughout the study period. These samples are useful when comparing with the new Washington State Water Quality Standards that adopted *E. coli* as the new bacterial indicator to protect water contact recreational uses (2020). Because the rulemaking change occurred after the study design and field sampling for this project, *E. coli* was not sampled routinely at every fixed-network site, and therefore was not used in the analysis.

While not enough *E. coli* samples were collected to create a distinct relationship between FC and *E. Coli*, a basic comparison between FC and *E. coli* bacteria concentrations shows a good relationship (R2=0.712). This supports the use of FC bacteria in this report to improve water quality conditions in the Padilla Bay watershed considering the recent adopted rulemaking to change to *E. coli* as the new bacteria indicator in 2020. As FC impairments are addressed, water quality conditions are expected to improve and meet new water quality standards using *E. coli* as the bacteria indicator. Additional information can be found in The Eastern Padilla Bay Tributaries Fecal Coliform Bacteria Total Maximum Daily Load: Water Quality Study Findings (McCarthy, 2020) technical report.

Downstream Uses

Pursuant to sections 303 and 101(a) of the Clean Water Act (CWA), the federal regulation at 40 CFR 131.10(b) requires that

> *"In designating uses of a water body and the appropriate criteria for those uses, the State shall take into consideration the water quality standards of downstream waters and shall ensure that its water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters."*

Padilla Bay has designated uses to both recreational use (Primary contact) and Harvest Use (All). Both Primary Contact Recreation Bacteria Criteria in Marine Water and Shellfish harvesting use standards are:

> *"Fecal coliform organism levels within an averaging period must not exceed a geometric mean value of 14 CFU or MPN per 100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained within an averaging period exceeding 43 CFU or MPN per 100 mL."*

This study addresses bacteria pollution in the freshwater tributaries draining into Padilla Bay, and the TMDL recommendations are based on freshwater FC standards. While the marine standards for FC in regards to shellfish harvesting are lower than freshwater criteria, the developed recommendations are still considered useful and protective of downstream beneficial uses due to the characteristics of Padilla Bay. None of the stream segments described by the TMDL are marine waters.

Freshwater discharged into Padilla Bay has a short residence time due to high levels of flushing (Bulthuis, 2013). Semidiurnal tides regularly flush the water out of Padilla Bay and into the estuarine water of north Puget Sound (Bulthuis, 2013). Due to this flushing, most of the freshwater that mixes with marine water in Padilla Bay enters Padilla Bay on the marine (northern and western) sides of the bay and is derived from the Fraser, Skagit, Nooksack, Samish, and other rivers that flow into the Strait of Georgia and north Puget Sound. Bulthuis (2013) estimated the maximum daily freshwater discharged into Padilla Bay from drainages in the watershed to be less than one percent of daily total exchange in Padilla Bay.

Downstream beneficial uses in Padilla Bay are expected be protected based on the TMDL recommendations in this study because of increased bacteria die-off (depending on temperature and light conditions) in marine waters, high mixing zones and low residence times in Padilla Bay, and distance from shellfish harvesting beds of approximately 3 miles from the closest tributary outlet (Fields, 2016; Bulthuis, 2013; Sargeant et al., 2006; Solic and Krstulovic, 1992; Mancini, 1978).

Targets

Once it is determined that water quality standards are not being met based on the concentration of FC bacteria, the bacterial load is calculated using the concentration data and stream discharge (the volumetric flow rate of water). If the current loading is higher than the standard, then the necessary reduction value is calculated to bring the water into compliance.

Everything flows downstream and the bacteria in the Padilla Bay watershed are no exception. Bacteria problems in the upper watershed will affect all the waters below it, right up to the bay itself. One way to visualize the current state of pollution levels is to look at the changing amount of bacteria reduction needed as you travel from upstream to downstream waters.

Figure 8 shows how bacteria loadings vary throughout the freshwater portions of the Padilla Bay watershed. In general, the total number of bacteria in Joe Leary Slough, No Name Slough, Big Indian Slough, and Little Indian Slough increases as you travel downstream, regardless of whether it is summer (dry season) or the winter (wet season). Additional information for individual tributaries water quality results are provided in Chapter 3.

The recommended cumulative reductions for the loading capacities were developed to focus on reducing bacteria sources in upstream areas of each slough. By addressing sources of pollution upstream, the amount of pollutant continuing to be carried downstream is reduced, downstream reductions may also be reduced, and water quality conditions downstream are expected to improve.

For example, if sample site one (upstream) has a bacteria concentration of 110 cfu/100 ml, and site two (downstream) has a concentration of 165 cfu/100 ml, then a reduction at site one of 75 cfu/100ml may reduce bacteria at both site one and two to below state standards, since the reduction of 75 cfu/100ml will also reduce total bacteria at site two.

These cumulative reductions will be used to guide an adaptive management strategy and implementation activities where efforts will be targeting upstream sources to protect downstream beneficial uses in the freshwater tributaries.

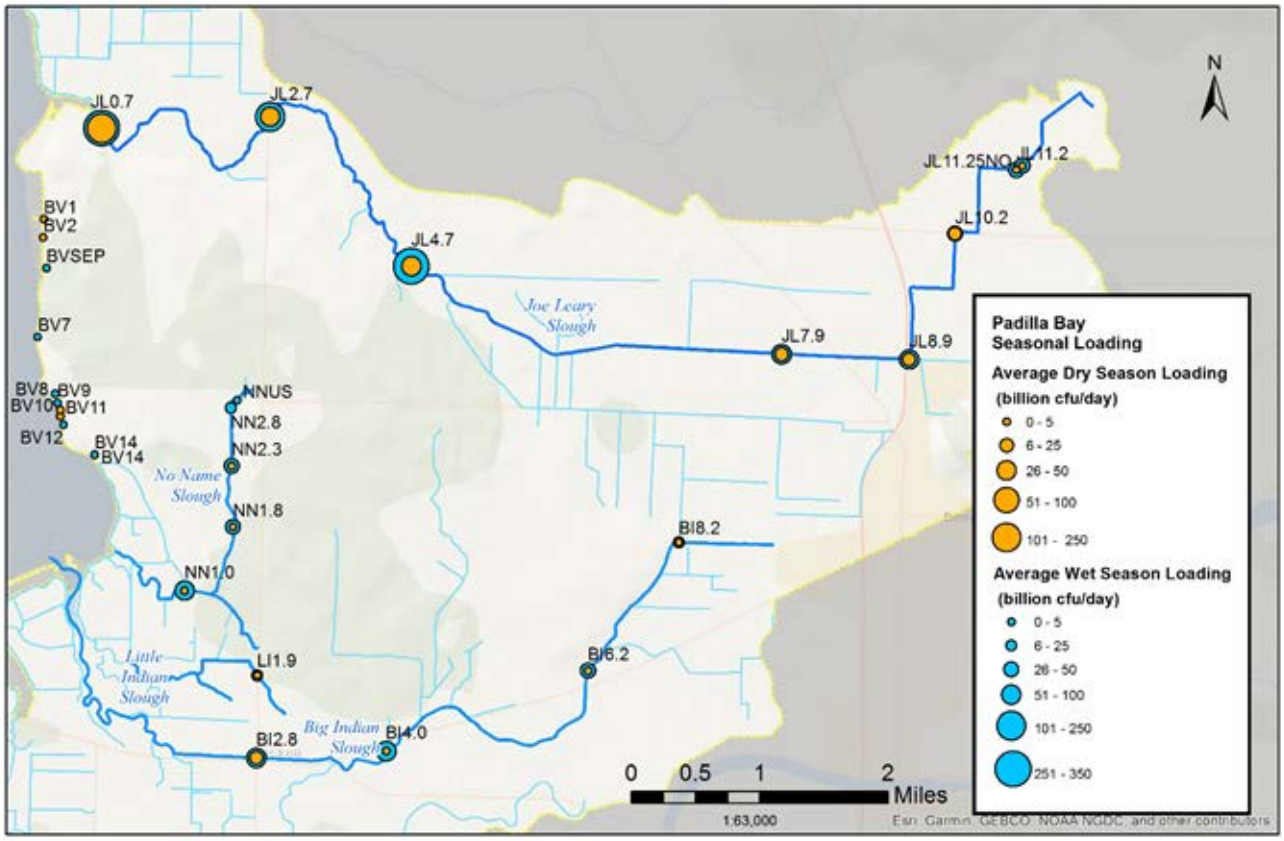


Figure 8 - Average current bacteria loadings for the wet and dry seasons. In general, overall loading increases as water moves from the headwaters to the outlet in both the wet and dry seasons.

Additional Data Sources

The Skagit County Conservation District has established the volunteer “Stream Team” to assess conditions within Skagit County, including areas within the Padilla Bay watershed. The team focuses on collecting samples during storm or runoff events. The staff are trained in proper sample collection procedures and field data collection, and work under a Quality Assurance/Quality Control plan.

Due to the difference in the sample protocol and locations, the results are not directly used within the TMDL report. However, the data can be used to characterize the conditions in the project area, evaluating current conditions, assist in source assessments, and evaluate implementation effectiveness over time.

Ongoing data collection and trend analysis efforts by the Skagit County Monitoring Program and its partners will be essential in refining the understanding of bacterial loading in the TMDL area, as well as refine local priority and implementation areas.

Potential Sources of Impairment

High levels of FC bacteria can indicate presence of pathogenic organisms that are found in warm-blooded animals (e.g., human, cows, horses, dogs, wildlife etc.) waste and pose potential health risks to people who recreate in contaminated waters. These sources of bacteria are broken down into point source and nonpoint sources.

Based on water quality data and permitted facility effluent limits, nonpoint sources are the dominant loading mechanism in the Padilla Bay study area. This means that the loading comes from diffuse sources spread throughout the watershed that are not required to have wastewater discharge permits.

The highest potential nonpoint sources of fecal coliform bacteria in this watershed include:

- Failing onsite septic systems in residential and business areas
- Improper management of waste from domestic pets
- Improper livestock and manure management
- Insufficient stormwater treatment or retention from impervious surfaces
- Human sources from recreational users or homeless population
- Concentration of waterfowl and other wildlife due to human activities

Point source wasteload allocations (WLAs) will be largely self-implementing through the administration of the National Pollution Discharge Elimination System (NPDES) Program. However, data collected during the TMDL, as well as local illicit discharge detection and elimination (IDDE) and monitoring efforts, have identified that high bacteria concentrations have been identified as likely originating from NPDES permitted facilities. Ecology TMDL and nonpoint staff are tasked to working with permit managers to conduct site reviews to evaluate site conditions, and ensure that new TMDL related requirements become permit conditions when permits are renewed.

Ecology initiated the process of developing a bacteria TMDL to identify sources of fecal contamination, and specify actions to reduce bacteria to levels that will support recreational beneficial uses.

Summaries of the potential sources of impairment can be found within each tributary summary section in Chapter 3.

Chapter 2: TMDL Allocations

TMDL Formula

Once it is determined that a waterbody does not meet standards, the goal of a TMDL is to provide a written, quantitative assessment of the water quality problems and of the pollutant sources that cause the problem, if known. This information is used to develop the "loading capacity" of the waterbody.

The EPA defines the loading capacity as "the greatest amount of loading that a water body can receive without violating water quality standards" (EPA, 2001). The loading capacity is then compared to the current amount of pollution entering the waterbody. If the pollutant levels are too high, the necessary reduction needed to bring a water body into compliance with the standards can be determined.

The allowable loading capacity for a waterbody is typically divided into the following categories:

- Wasteload allocation and point source discharges - If the pollutant comes from a discrete (point) source subject to a National Pollutant Discharge Elimination System (NPDES) permit, such as a municipal or industrial facility's discharge pipe, that facility's share of the loading capacity is called a Wasteload Allocation (WLA). All permitted facilities are subject to pollutant limits and may have a monitoring requirement.
- Load allocation and nonpoint discharges - If the pollutant comes from diffuse (nonpoint) sources not subject to an NPDES permit, such as general urban, residential, or farm runoff, the cumulative share is called a Load Allocation (LA). The LA quantifies how much of the pollutant(s) can be discharged from nonpoint sources, however, due to the diffuse nature of the loading, the LA is often an estimate based on factors such as land use, slope, and precipitation within a watershed.
- Margin of Safety - All TMDLs must also include a margin of safety (MOS). The MOS is an allowance so that surface water quality standards will be met under the worst conditions likely to be experienced.
- A reserve capacity - This factor estimates the effect of population growth and future land uses on pollutant WLAs and LAs so they will continue to be effective in the future.

When there are differences in water quality during prolonged periods of wet and dry weather, loading capacity is also assessed by season to document those variations in flows and contaminant concentrations. This ensures that water quality standards are met during all seasons of the year.

Therefore, a TMDL is the sum of the wasteload allocations (WLAs), load allocations (LAs), the margin of safety (MOS), and a reserve capacity (if included). The formula that describes the TMDL is as follows:

$$\textbf{\textit{Loading Capacity}} = \sum \textbf{\textit{WLA}} + \sum \textbf{\textit{LA}} + \textbf{\textit{MOS}}$$

Analytical Framework

Loading capacities, LAs, and WLAs are expressed in terms of daily time increments (mass-per-time). Washington State water quality criteria are expressed as concentration (mass-per-volume). Washington State bacteria TMDLs typically use a combination of loads and statistical percent reductions to define loading capacities and LAs (Lawrence and Swanson, 2013; Lawrence, 2009; Mathieu and James, 2011; Pickett, 1997; Swanson, 2008).

The statistical rollback method (Ott, 1995) is used to calculate FC reduction targets for stream segments. The rollback method compares monitoring data to standards; the difference is the percentage change needed to meet the standards. Ecology has applied the rollback method in many other bacteria water quality studies (Coots, 2002; Fields, 2016; Joy, 2006; Joy and Swanson, 2005; Mathieu and James, 2011; McCarthy, 2018; Pelletier and Seiders, 2000; Swanson, 2009).

Ideally, at least 20 samples taken throughout the year are needed from a broad range of hydrologic conditions to determine an annual bacteria distribution. If bacteria sources vary significantly by season causing distinct critical seasons, seasonal targets may be required. Fewer data provide less confidence in bacteria reduction targets, but the rollback method is robust enough to provide pollutant allocations and targets for planning implementation measures. Compliance with the most restrictive of the dual bacteria standard criteria determines the bacteria reduction needed at a stream sampling site. The rollback method is applied as follows:

> *The geometric mean (approximate median in a log-normal distribution) and 90th percentile statistics are calculated and compared to the water quality bacteria criteria. If one or both do not meet the criteria, the whole distribution is "rolled-back" to match the more restrictive of the two criteria. The 90th percentile criterion is usually the most restrictive.*

The rolled-back geometric mean or 90th percentile bacteria value then becomes the recommended target bacteria value for the site. The term target is used to distinguish these estimated numbers from the actual water quality criteria. The degree to which the distribution of bacteria counts is rolled-back to the target value represents the estimated percent of bacteria reduction required to meet the bacteria water quality criteria and standards.

The bacteria targets are only in place to assist water quality managers in assessing the progress toward compliance with the bacteria water quality criteria. Compliance is ultimately measured as meeting both parts of the water quality criteria. Any water body with bacteria targets is expected to:

Meet both the applicable geometric mean and "percent exceedance" criteria.

- Protect designated uses for the category.

The rollback method assumes that the distribution of data follows a log-normal distribution. Bacteria concentrations from each of the sites were tested for log-normality prior to the use of the roll-back method. In all instances, the data sets met the log-normality test. Sites that were not log-normally distributed were not used as part of the statistical rollback analysis. The cumulative probability plot of the observed bacteria data gives an estimate of the geometric mean and 90th percentile which can then be compared to the bacteria concentration standards.

Additional information regarding this method can be found in the "Eastern Padilla Bay Tributaries Fecal Coliform Bacteria Total Maximum Daily Load Study: Water Quality Study Findings[2]" as well as Appendix E.

Seasonal Patterns in Bacteria Levels

Bacteria concentrations frequently vary by season due to changes in stream flow, precipitation levels, and land use. Time periods when bacteria levels are the highest are called critical conditions or critical periods.

During wet weather periods, bacteria concentrations are generally much higher than during dry periods, and often exceed the numeric targets. Therefore, wet weather conditions can be considered a critical season for bacteria levels. However, during the summer, low-flow period there is a higher potential to bacteria exposure through recreation. Low flow conditions can also lead to warm, stagnant water, where bacteria regrowth may occur. Seasonal differences in bacteria concentrations occurred throughout the Padilla Bay watershed, and two seasons of critical conditions (wet and dry seasons) were observed based on historical precipitation data:

- Wet season (October-April).
- Dry season (May-September).

Critical seasons were determined at sites with adequate data collected during both wet and dry seasons (more than five samples) by evaluating flow conditions and bacterial concentrations. The critical season was determined based on the season which required the largest reductions to meet standards. An annual value was assigned to sites without adequate fecal coliform data for both seasons or for sites that had similar FC exceedances during both wet and dry periods. Generally, most sites had a wet critical season, three sites had a dry critical season, and five sites were assigned an annual critical period. There is not a strong spatial pattern to where and when critical conditions occurred (Figure 9).

Further descriptions about how these critical seasons were determined are in Appendix D.2. Stream flow information collected during the TMDL can be found in the "Eastern Padilla Bay

[2] https://fortress.wa.gov/ecy/publications/documents/2003001.pdf

Tributaries Fecal Coliform Bacteria Total Maximum Daily Load Study: Water Quality Study Findings[3]"

For this TMDL, LAs and WLAs were developed for wet and dry seasons for Joe Leary and Big Indian Sloughs. Due to low flows during the dry season and limited data, annual (non-seasonal) values were estimated for Little Indian and No Name Sloughs.

[3] https://fortress.wa.gov/ecy/publications/documents/2003001.pdf

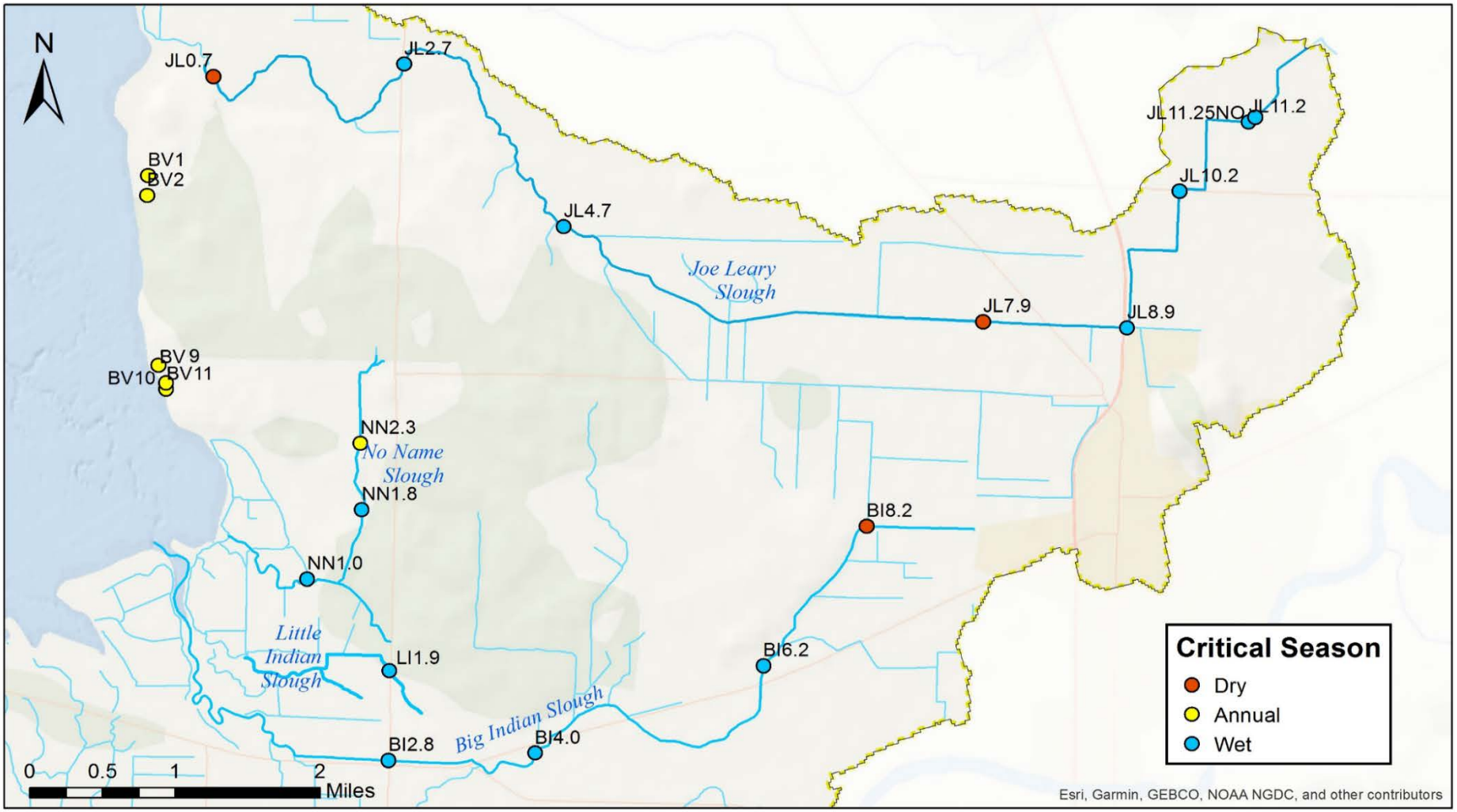


Figure 9 - Critical conditions for bacteria levels in the Padilla Bay watershed. Critical conditions occurred during the wet season at 13 of the 21 sites shown. Dry season critical periods occurred sporadically at three locations.

Loading Capacity

The loading capacity is the maximum amount of a substance or pollutant that a waterbody can accept from all sources before it exceeds water quality standards and is considered polluted. It provides a reference for calculating the amount of pollution reduction needed to bring a water body into compliance with the standards. Table 4 illustrates the loading capacity of the tributaries in the Padilla Bay watershed at the furthest downstream freshwater site.

Table 4 - Loading capacity for the Padilla Bay watershed

Site	Loading Capacity- Wet Season (billion cfu/day)	Loading Capacity-Dry Season (billion cfu/day)	Loading Capacity-Annual (billion cfu/day)
JL0.7	197.4	81.0	-[1]
BI2.8	75.9	16.4	-[1]
LI1.9/NN1.0	-[2]	-[2]	18.0

[1] - Not applicable, season loading and reductions calculated

[2]- Not applicable, annual reduction values calculated due to low flows and limited dry season data.

Loading capacities were calculated using a combination of FC concentrations (unit per volume) and flow (watercourse volume over time). Typically, flows increase as you move from the headwaters and tributaries to the main stem of a watercourse and so does the loading capacity. Additionally, the critical season that is associated with the highest water quality standard violations is considered when determining the loading capacity.

The loading capacity expresses the amount of bacteria (billion cfu/day) that a site is allotted using FC concentrations needed to meet water quality standards. Loading capacities were estimated using the geometric mean FC criterion (100 cfu/100 mL) to protect recreational contact beneficial uses. Further methodology for estimating the loading capacity for each site is in Appendix E.1.

Wasteload Allocations

Wasteload allocations (WLAs) are determined for point sources of pollutants that are regulated under the National Pollutant Discharge Elimination System (NPDES) permit, such as industrial or municipal discharges. WLAs are developed as part of a TMDL when National Pollution Discharge Elimination Systems (NPDES) regulated stormwater discharges are present (40CFR 130.2(h)) and contribute to pollutant loading. Five types of NPDES permits are present in the Padilla Bay watershed: municipal separate stormwater sewer systems (MS4s), sand and gravel stormwater, industrial stormwater, construction stormwater, and individual industrial permits.

Individual permits WA0991008 and WA0031283 (Table 5 and 6) discharge into surface water within the study area, with the remainder of individual permitted facilities discharging into either groundwater or sewer systems.

Flow data were obtained from Ecology's Water Quality Permitting and Reporting Information System (PARIS) for permits WA0991008 and WA0031283 draining into surface waters; these data were averaged by season as an average flow. Daily WLAs for both the wet and dry seasons were calculated using a bacteria concentration value of 100 cfu/100 mL, consistent with MS4 and other general permits. Table 7 is a summary of individual permits under various flow conditions.

There are a series of general permits in the study area that were assigned WLAs. Individual NPDES permits within the Padilla Bay watershed are assigned WLAs, and these estimation methods are described in Appendix E.

Table 5 - WA0991008 Wasteload Allocation Summary

Permittee Name	Hughes Farms
Permit Number	WA0991008
Permit Type	Industrial NPDES IP
Waterbody Names	Little Indian Slough/No Name Slough (catchment ID 210593).
Listing ID of Receiving Water	No current listing ID, reach identified as TBD4 for the purposes of the TMDL

WLA	Unit	Pollutant	Critical Period	Additional Information
0.34	billion cfu/day	FC Bacteria	Wet	Discharge to Catchment 210593
0.30	billion cfu/day	FC Bacteria	Dry	Discharge to Catchment 210593

Other Load Limits and Requirements	Appropriate best management practices (BMPs) required through stormwater permits for controlling pollutant loadings to surface waters are applied to each stormwater discharge to protect designated aquatic uses. Ecology anticipates that there will be no additional TMDL-required conditions in stormwater permits based on existing information. TMDL does not contain any additional TMDL-related actions for stormwater permittees.

Table 6 - Permittee WA0031283 Wasteload Allocation Summary

Permittee Name	Chemtrade Sulex Inc.
Permit Number	WA0031283
Permit Type	Industrial NPDES IP
Waterbody Names	Little Indian Slough/No Name Slough (catchment ID 210593).
Listing ID of Receiving Water	No current listing ID, reach identified as TBD4 for the purposes of the TMDL

WLA	Unit	Pollutant	Critical Period	Additional Information
.15	billion cfu/day	FC Bacteria	Wet	Discharge to Catchment 210593

Other Load Limits and Requirements	Appropriate best management practices (BMPs) required through stormwater permits for controlling pollutant loadings to surface waters are applied to each stormwater discharge to protect designated aquatic uses. Ecology anticipates that there will be no additional TMDL-required conditions in stormwater permits based on existing information. TMDL does not contain any additional TMDL-related actions for stormwater permittees.

Additional maps of permit areas and coverage locations can also be found in Appendix E. Anticipated TMDL-related requirements for NPDES permittees (if any) are discussed later in Chapter 3, Implementation Plan.

Table 7 - Summary Table, seasonal flows used to calculate individual permit allocations

Individual Permit	Dry Season Flow (cfs)	Dry Season Daily WLA (billion cfu/day)	Wet Season Flow (cfs)	Wet Season Daily WLA (billion cfu/day)	Annual Flow (cfs)	Annual WLA (billion cfu/day)
Hughes Farms	0.12	0.30	0.14	0.34	0.13	0.32
Chemtrade Sulex, Inc.	--	--	0.06	0.15	0.06	0.15

Portions of Skagit County and City of Burlington have been issued coverage under the NPDES Phase II MS4 general permit (Figure 10). Washington State Department of Transportation (WSDOT) highways and facilities are also covered under an MS4 permit within Phase I and II areas plus any TMDL areas that may be outside the Phase I and II permit areas (refer to Appendix E, Figure E.1 for additional information). Drainage District 19 and the Port of Skagit are secondary permittees, and are also given WLA values (Tables 8 through 12) based on service area boundaries. Please note that these values are based on the best available information at the time of the TMDL. Additional refinement of the areas is ongoing as MS4

infrastructure is currently being mapped for both MS4 permittees and Secondary permittees. WLA values may be refined as additional data becomes available.

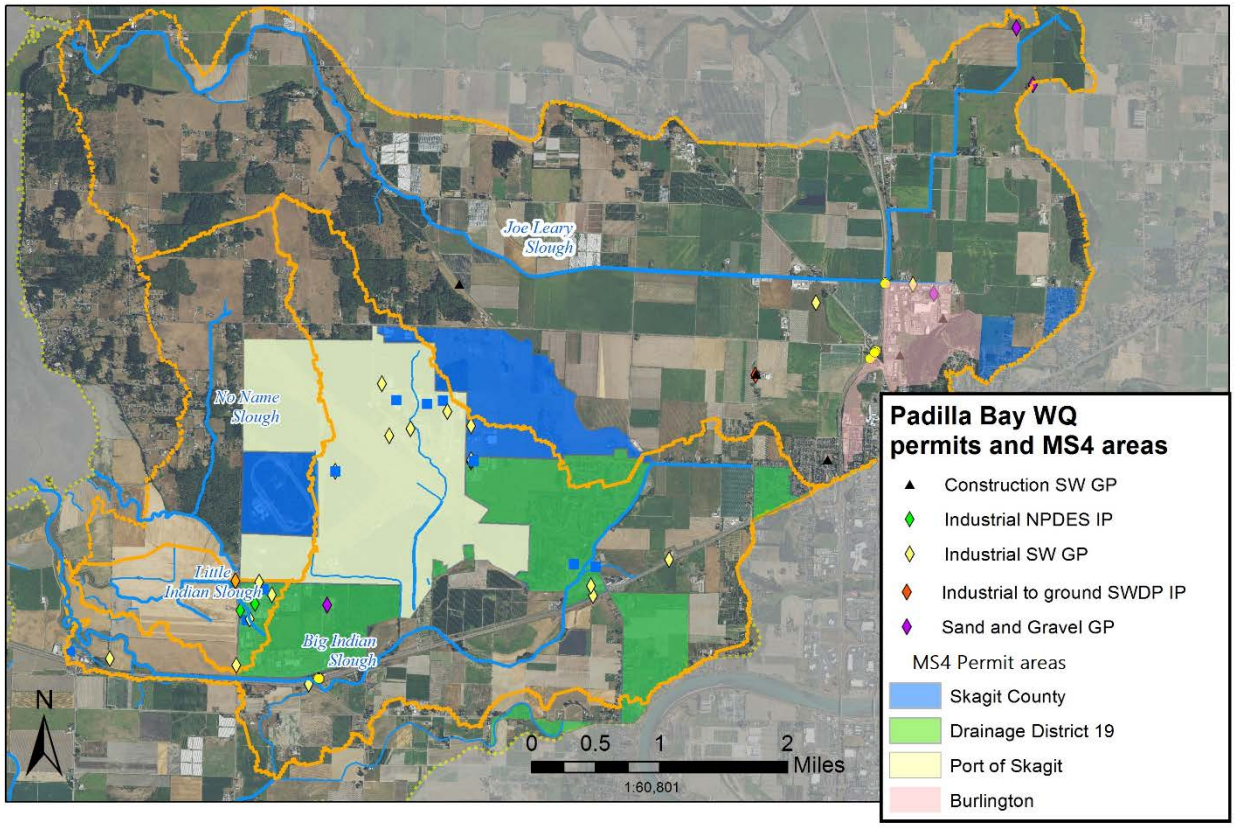


Figure 10 - NPDES Permits and permit coverage areas. NPDES permit holders in the Padilla Bay Watershed include Skagit County, the Port of Skagit, Drainage District 19, the City of Burlington, WSDOT, and a wide variety of businesses and construction sites.

Ecology established WLAs using the state freshwater recreational contact geometric mean criterion as the acceptable maximum bacteria level, known stormwater runoff characteristics, local precipitation data, land use data, and permit information. The "Simple Method" was used to estimate the relative loading from permitted sources and develop aggregated WLAs (Schueler, 1987).

The WLAs were developed for both wet and dry seasons based on the influence of precipitation on runoff in this watershed and the elevated levels of FC during this period (Table 13). The TMDL analysis for calculating WLAs can be found in Appendix E.2. Appendix E contains a more detailed description for applying the "Simple Method" for the development of WLAs for this TMDL and a list of all water quality permits in the study area.

Table 8 - Skagit County Wasteload Allocation summary

Permittee Name	Skagit County
Permit Number	WAR045556
Permit Type	Municipal SW Phase II Western WA GP
Waterbody Names	Joe Leary Slough, Big Indian Slough, No Name Slough, and Little Indian Slough
Listing ID of Receiving Water	Joe Leary (39608, 39607, 16410), Big Indian (45711, TBD1, TBD2, TBD3), No Name (7158), Little Indian (TBD4)

WLA	Unit	Pollutant	Critical Period	Additional Information
5.3	billion cfu/day	FC Bacteria	Wet	WLA based on estimated MS4 area
1.8	billion cfu/day	FC Bacteria	Dry	WLA based on estimated MS4 area

Other Load Limits and Requirements	Appropriate best management practices (BMPs) required through stormwater permits for controlling pollutant loadings to surface waters are applied to each stormwater discharge to protect designated aquatic life uses. The following activities not currently included in Skagit County's MS4 permit can contribute to meeting that WLA and will be considered by Ecology in the next permit cycle (2024): • Installation and maintenance (including disposal) of Pet waste stations in areas subject to the MS4 boundary areas. • Including bacteria sampling as a part of the IDDE work described in the permit.

Table 9 - Port of Skagit Wasteload Allocation summary

Permittee Name	Port of Skagit
Permit Number	WAR045700
Permit Type	Municipal SW Phase II Western WA GP
Waterbody Names	Big Indian Slough, No Name Slough, and Little Indian Slough
Listing ID of Receiving Water	Big Indian (45711, TBD1, TBD2, TBD3), No Name (7158), Little Indian (TBD4)

WLA	Unit	Pollutant	Critical Period	Additional Information
9.5	billion cfu/day	FC Bacteria	Wet	WLA based on estimated MS4 area
2.3	billion cfu/day	FC Bacteria	Dry	WLA based on estimated MS4 area

Other Load Limits and Requirements	Appropriate best management practices (BMPs) required through stormwater permits for controlling pollutant loadings to surface waters are applied to each stormwater discharge to protect designated aquatic life uses. The following activities not currently included in the Port of Skagit MS4 permit can contribute to meeting that WLA and will be considered by Ecology in the next permit cycle (2024): • Installation and maintenance (including disposal) of Pet waste stations in areas subject to the MS4 boundary areas. • Including bacteria sampling as a part of the IDDE work described in the permit.

Table 10 - Drainage District 19 Wasteload Allocation summary

Permittee Name	Drainage District 19
Permit Number	WAR045710
Permit Type	Municipal SW Phase II Western WA GP
Waterbody Names	Big Indian Slough
Listing ID of Receiving Water	Big Indian (45711, TBD1, TBD2, TBD3), Little Indian (TBD4)

WLA	Unit	Pollutant	Critical Period	Additional Information
7.1	billion cfu/day	FC Bacteria	Wet	WLA based on estimated MS4 area
1.7	billion cfu/day	FC Bacteria	Dry	WLA based on estimated MS4 area

Other Load Limits and Requirements	Appropriate best management practices (BMPs) required through stormwater permits for controlling pollutant loadings to surface waters are applied to each stormwater discharge to protect designated aquatic life uses. The following activities not currently included in the phase II MS4 permit can contribute to meeting that WLA and will be considered by Ecology for these entities in the next permit cycle (2024): • Installation and maintenance (including disposal) of Pet waste stations in areas subject to the MS4 boundary areas. • Including bacteria sampling and screening as a part of the IDDE work described in the permit.

Table 11 - City of Burlington Wasteload Allocation summary

Permittee Name	City of Burlington
Permit Number	WAR045551
Permit Type	Municipal SW Phase II Western WA GP
Waterbody Names	Joe Leary Slough
Listing ID of Receiving Water	Joe Leary (39608, 39607, 16410), Big Indian (TBD3)

WLA	Unit	Pollutant	Critical Period	Additional Information
1.9	billion cfu/day	FC Bacteria	Wet	NA
0.6	billion cfu/day	FC Bacteria	Dry	NA

Other Load Limits and Requirements	Appropriate best management practices (BMPs) required through stormwater permits for controlling pollutant loadings to surface waters are applied to each stormwater discharge to protect designated aquatic life uses. The following activities not currently included in the phase II MS4 permit can contribute to meeting that WLA and will be considered by Ecology for these entities in the next permit cycle (2024): • Installation and maintenance (including disposal) of Pet waste stations in areas subject to the MS4 boundary areas. • Including bacteria sampling and screening as a part of the IDDE work described in the permit.

Table 12 - WSDOT Wasteload Allocation summary

Permittee Name	Washington Department of Transportation
Permit Number	WAR043000
Permit Type	Municipal SW Phase GP
Waterbody Names	Joe Leary Slough and Big Indian Slough
Listing ID of Receiving Water	Joe Leary (39608, 39607), Big Indian (45711)

WLA	Unit	Pollutant	Critical Period	Additional Information
0.8	billion cfu/day	FC Bacteria	Wet	NA
0.3	billion cfu/day	FC Bacteria	Dry	NA

Other Load Limits and Requirements	The following activities not currently included in the phase II MS4 permit can contribute to meeting that WLA and will be considered by Ecology for these entities in the next permit cycle (2024): • If stormwater discharges that transport bacteria over natural background levels to listed receiving waters are found from sources within WSDOT's right-of-way and control, WSDOT will apply WSDOT Municipal Stormwater Permit BMPs from their SWMP or perform remediation to correct bacteria discharges. For run-on sources of bacteria identified by WSDOT that are from outside of WSDOT's right-of-way, WSDOT will notify Ecology and work cooperatively with Ecology, the local jurisdiction, and other parties involved for their resolution. (As needed) • WSDOT will work with Ecology and Skagit County to determine potential sources of fecal coliform within WSDOT's right-of-way and control on a limited number of high priority stormwater discharge locations to Padilla Bay. This work may include but is not limited to site visits, data review, and collaborative problem solving. (On-going)

Table 13 - WLA for permit holders in watershed.

Permit	Wet Season – Avg Daily Load (billion cfu/day)	Dry Season – Avg Daily Load (billion cfu/day)	Annual – Avg Daily Load (billion cfu/day)
Skagit County (WAR045556)	5.3	1.8	3.9
Drainage District 19 (WAR045710)	7.1	1.7	5.2
Port of Skagit (WAR045700)	9.5	2.3	6.9
City of Burlington (WAR0455551)	1.9	0.6	1.4
WSDOT (WAR043000)	0.8	0.3	0.6
GP Sand & Gravel	0.0**	0.0**	0.0**
GP Construction SW	0.8	0.3	0.6
GP Industrial SW	8.1	2.7	5.8
IP Industrial (WA0991008)	0.3	0.3	0.3
IP Industrial (WA0031283)	0.2	0.0**	0.2

GP = general permit; IP = individual permit; MS4 = municipal separate stormwater sewer systems;
*sum of individual industrial permits; **minimal WLA (<0.01 billion cfu/day)

WLAs were calculated for the furthest downstream freshwater site for each major slough (JL0.7, NN1.0, LI1.9, and BI2.8) to account for all point sources located within the watershed (Table 12). WLAs estimated using the Simple Method were combined with load estimates for individual permits. Overall, point sources account for 16% of the loading capacity during the wet season and 24% of the total loading capacity during the dry season.

Table 14 - WLAs at tributary outlets

Slough	Site	Wet Season Daily WLA (billion cfu/day)	Dry Season Daily WLA (billion cfu/day)	Annual Daily WLA (billion cfu/day)
Joe Leary	JL0.7	13.6	4.6	-[1]
Big Indian	BI2.8	15.3	5.2	-[1]
Little Indian/No Name	LI1.9/ NN1.0	-[2]	-[2]	3.4

[1] - Not applicable, season loading and reductions calculated
[2] - Not applicable, annual reduction values calculated due to limited dry season data

Load Allocations

Load allocations (LAs) represent the maximum amount of FC allowed from nonpoint sources in the watershed. Like WLAs, they are expressed in billion cfu/day. Because this TMDL aggregates WLAs for point sources, LAs are assigned for Joe Leary Slough, Big Indian Slough, and combined Little Indian and No Name Sloughs after point source WLAs are achieved. A summary of the LA is included for each tributary below (Table 15).

LAs were developed for nonpoint sources of FC in the study area for both the wet and dry seasons (Joe Leary and Big Indian Sloughs) and annually (combined Little Indian and No Name Sloughs). These LAs were calculated by subtracting the relative contribution of point sources to bacteria loading (WLA) from the estimate loading capacity at the furthest downstream freshwater site for the sloughs (JL0.7, NN1.0, BI2.8, and LI1.9).

Table 15 - Load allocations at Tributary outlets

Waterbody Name	Load Allocation (billion cfu/day)	Critical Condition Period	Reductions Needed to Meet Allocation
Joe Leary	183.8	Wet	14%
Joe Leary	76.4	Dry	50%
Big Indian	60.6	Wet	23%
Big Indian	11.2	Dry	<10%
Little Indian/ No Name	14.6	Annual	81% (LI)/ 61% (NN)

This TMDL anticipates that WLA for permittees will be expressed through additional activities established in their NPDES permits, and has worked with NPDES permit managers to review permits and potential permit language. Therefore, it is practical to measure LA compliance through direct measurement of local waters to determine if TMDL goals are being fully met. This TMDL discusses the pollution problems in each of the four major subbasins in the Padilla Bay watershed in more detail in Chapter 3.

Margin of Safety

The federal Clean Water Act requires that TMDLs be established with a margin of safety (MOS). The MOS accounts for uncertainty in the available data, or the unknown effectiveness of the water quality controls that are put in place. The MOS can be stated explicitly by setting a specific allocation as a MOS, or as an implicit MOS by using conservative assumptions in the use of data, analysis, and the effectiveness of proposed management practices.

This TMDL provides implicit MOS by the following:

- The more conservative bacteria concentration (100 cfu/100 mL) value was used to estimate LA and WLAs. This conservative approach will help to achieve both water quality criteria, with a geometric mean less than 100 cfu/100 mL and not more than 10 percent of samples exceeding 200 cfu/100 mL.
- This work did not take into account bacteria die-off through a decay rate. Although sunlight and temperature reduce bacteria survival, it is assumed that fecal coliform bacteria entering the watershed will stay active and suspended in the water column to the mouth of the water body. The simple mass balance calculations and subsequent derivation of target values in freshwater assumed no FC die-off. Assuming bacteria levels are persistent and there is no natural attenuation adds to the MOS.
- The relatively small size of each of the slough subbasins and relatively large size of parcels throughout much of the watershed will help ensure the success of local source identification and correction efforts. As sources are corrected in upper subbasins, water quality in downstream areas will become more attainable.

Reserve Capacity

A reserve capacity is included within a TMDL to account for future loads from growth pressures or new permitted sources that did not exist at the establishment of the TMDL allocation values. The reserve capacity of this TMDL was calculated as ten percent of the total loading capacity.

TMDL Calculation

Little Indian and No Name Slough are both located within the same National Hydrologic Dataset Plus (NHDPlus) high resolution dataset catchment (210593). While a boundary for each tributary was developed based on available topographic data, the actual boundaries have not been field verified. Additionally, local agricultural and MS4 drainage infrastructure, including surface and subsurface drainage, may have altered the flow paths and discharge locations to areas outside of the two sloughs.

Although the permitted facilities within these sloughs were used to develop the WLA values for Little Indian and No Name Sloughs individually, the values are presented as a combined value. This is purposely done to avoid any potential inconsistencies in the accounting of the WLA and LA values in the area due to drainage alterations or watershed boundary errors, as well as differences in the modeled WLA values and the loading capacity values based on field measurements.

The WLA for Little Indian and No Name Sloughs are presented as annual, non-seasonal values (applied throughout the entire year) due to low flows during the dry season and limited data at these sites. Seasonal (wet and dry season) WLAs were developed for Joe Leary and Big Indian Sloughs.

The seasonal WLAs for Joe Leary Slough and Big Indian Slough and the annual WLAs for combined Little Indian and No Name Sloughs for each permittee are presented in the table below (Table 16).

Table 16 - Padilla Bay TMDL Summary Table by tributary watershed.

Permit category and TMDL values	Joe Leary (JL0.7) Wet Season (b.cfu/day)	Joe Leary (JL0.7) Dry Season (b.cfu/day)	Big Indian (BI2.8) Wet Season (b.cfu/day)	Big Indian (BI2.8) Dry Season (b.cfu/day)	Little Indian and No Name (LI1.9&NN1.0) Annual (b.cfu/day)
MS4 Skagit County & Secondary Permittees WLA	3.6	1.2	14.2	4.8	2.9
MS4 City Burlington WLA	1.9	0.6	0.0	0.0	0.0*
WSDOT WLA	0.4	0.1	0.5	0.2	0.0*
GP Sand & Gravel WLA	0.0**	0.0**	0.0**	0.0**	0.0*
GP Construction SW WLA	0.4	0.1	0.4	0.1	0.0
GP Industrial SW WLA	7.4	2.5	0.3	0.1	0.2
Individual Permit WLA	0.0*	0.0*	0.0*	0.0*	NA
Individual Permit WA0031283 WLA	NA	NA	NA	NA	0.2
Individual Permit WA0991008 WLA	NA	NA	NA	NA	0.3
Total WLA	**13.6**	**4.6**	**15.3**	**5.2**	**3.6**
Total LA	**165.5**	**68.8**	**54.5**	**10.1**	**13.0**
Reserve Capacity	**18.3**	**7.6**	**6.1**	**1.1**	**1.4**
Loading Capacity	**197.4**	**81.0**	**75.9**	**16.4**	**18.0**

*No current WLA values based on permittees within the tributary. Future permittees will be assigned values based on site and permit criteria. **Minimal WLA (<0.01 billion cfu/day)

Values shown in Table 17 are loading capacities estimated from geometric mean criterion (100 cfu/100 mL) and the bacteria load (and percent) reductions needed to meet criteria. Progressive reductions assume that bacteria loads are reduced upstream. If no reductions upstream occur, then the individual reductions are needed. A full list of individual or progressive reductions can be found in appendix E.

Table 17 - Wet and Dry season reductions for eastern Padilla Bay watershed tributaries.

Site	Wet Season LC b.cfu/ day[1]	Wet Season Reductions[2] b.cfu/day (%)	Dry Season LC (b.cfu/day)	Dry Season Reductions[2] b.cfu/day (%)	Annual LC (b.cfu/day)	Annual Reductions[2] b.cfu/day (%)
JL0.7	197.4	63.2 (14%)	81.0	161 (50%)	-[3]	-[3]
BI2.8	75.9	44.6 (23%)	16.4	0.0[4] (<10%)	-[3]	-[3]
LI1.9/ NN1.0	-[5]	-[5]	-[5]	-[5]	18.0	12.2 (81%)/ 50.9 (61%)

[1] -b.cfu/day= billion cfu/day; LC= load capacity;
[2]- based on 90th percentile criterion (200 cfu/100 mL);
[3] – Not applicable, season loading and reductions calculated
[4] - 0.0 (<10%) indicates minimal reduction needed;
[5] - Not applicable, Annual reduction values calculated due to limited dry season data

Chapter 3: Implementation Plan

Introduction

This implementation plan was developed by Ecology and interested and responsible parties. It describes what needs to be done to improve water quality. It explains the roles and authorities of cleanup partners (those organizations with jurisdiction, authority, or direct responsibility for cleanup), along with the programs or other means through which they will address these water quality issues. It prioritizes specific actions planned to improve water quality and achieve water quality standards. TMDL reductions should be achieved by 2031.

While each slough and subbasin may have different pollution sources due to the mix of rural, urban, and undeveloped areas, the implementation efforts are similar across the watershed. The methods in this plan are general in nature and combinations of practices will likely yield the best results.

This plan describes the water quality problems in the watershed and nonprofit watersheds, and defines actions necessary to address known or potential loading sources. It also provides the details needed to satisfy the Environmental Protection Agency's (EPA) nine key elements of a watershed plan. It includes:

1. Identification of the causes of impairment and pollution sources
2. An estimate of the load reductions expected from management measures
3. Description of the nonpoint source management measures and BMPs
4. An estimate of the technical and financial assistance needed
5. Information and education to be provided in the watershed
6. Schedule for implementing needed BMP)
7. Description of interim milestones
8. Criteria to determine if load reductions are being met
9. Monitoring to evaluate effectiveness of the plan

While the plan lists both the general implementation actions and specific needs of each nonprofit watershed, it is not an exhaustive list and may be updated to include new projects, priorities, and approaches over time. For organizations with NPDES permits administered by Ecology, any water cleanup activities identified in this TMDL will be re-evaluated at the time of permit reissuance and incorporated into the permit language or associated guidance documents. Other beneficial water cleanup practices to reduce sediment transport, increase water retention, or control other pollutants may reduce bacterial loading as a secondary benefit. Site-specific or innovative approaches should be considered when traditional BMPs are not an option.

The plan also includes recommendations for local organizations that will be leading on-the-ground efforts to improve water quality. Ecology staff will continue to provide organizational support for local water quality forums and programs, participate in watershed groups, offer competitive funding opportunities, and provide technical assistance to reduce bacterial loading.

Land Use and Areas with Elevated Pollution Levels

Land use within the watershed is predominately agriculture (Figure 11). Most of the agricultural activity is commercial, or large-scale farming with the intent of selling a product, rather than rural agriculture, which is a mixture of small-scale farm, rural residences, pastures, and hay fields (Fields, 2016). As of 2010, the average farm size was 99 acres with most farms under 50 acres (USDA, 2012).

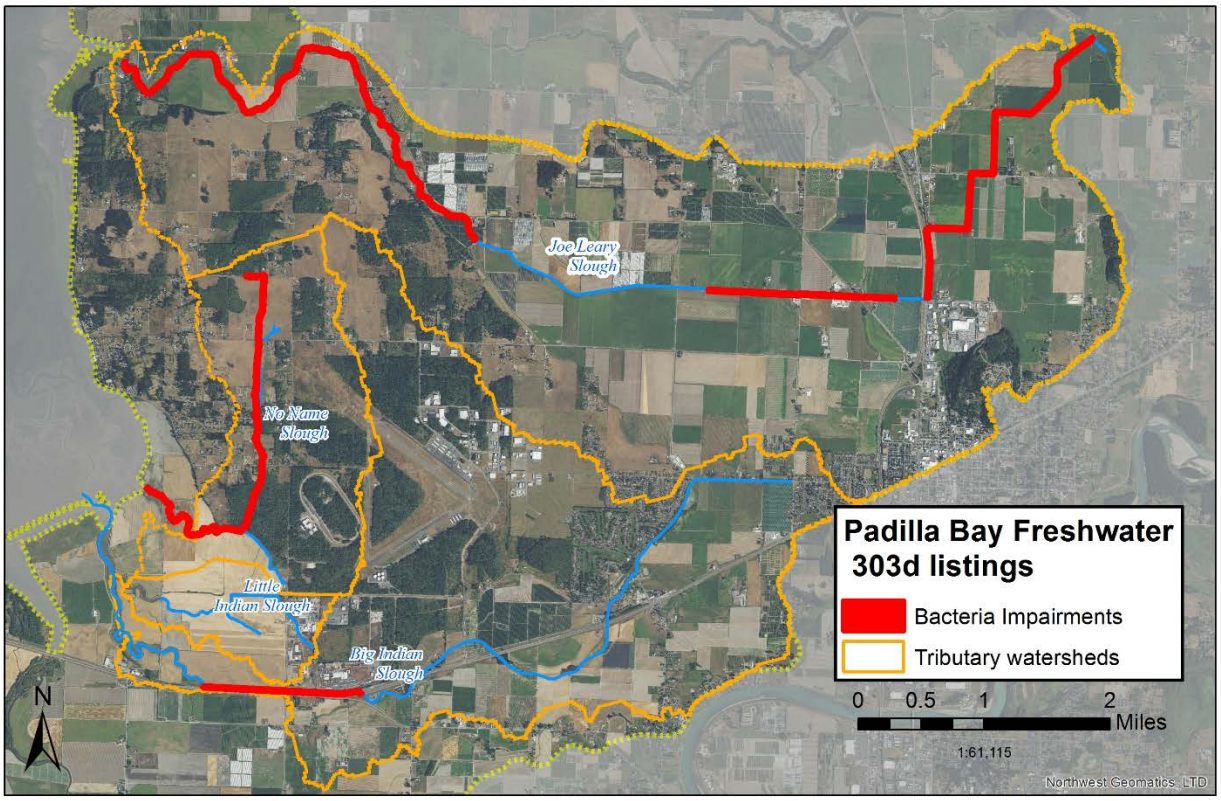


Figure 11 - Eastern Padilla Bay watershed overview with all impaired waters on the 303d list.

Ecology estimated the relative land use for each slough's subbasin (Figure 12) using land use data from 2010 (Washington State Parcel Based Land Use). Joe Leary and Little Indian sloughs are comprised of 79 and 86 percent agriculture respectively, with assorted mixed land use for the rest of the subbasin. No Name and Big Indian sloughs were both approximately 50 percent agricultural, followed by roads and transportation, residential, industrial/commercial areas.

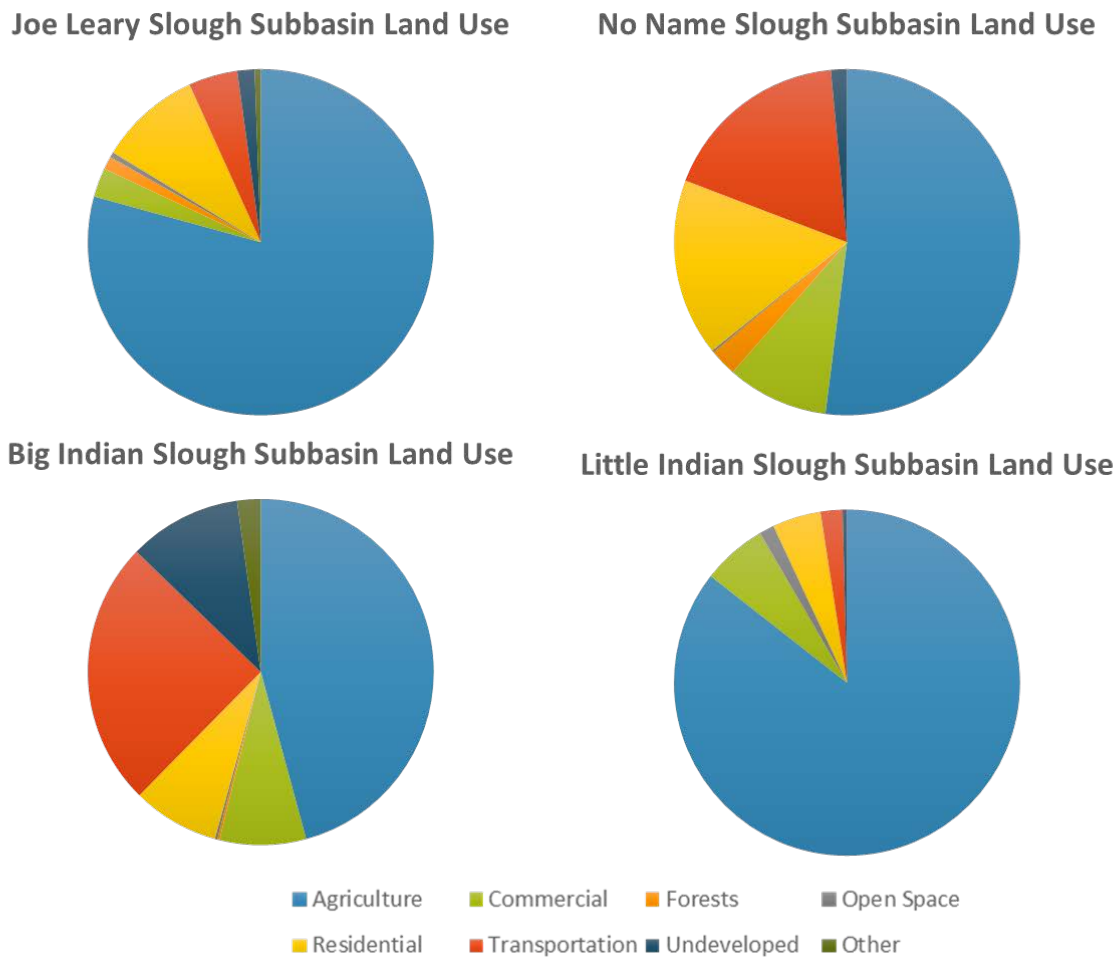


Figure 12 - Land use summary for each major subbasin in the Padilla Bay watershed

Hydrologic modifications that affect water quality

Maintained agricultural waterways run along roads in much of the watershed. Many ditches also drain pastures, fields, and forest areas to flow into roadside ditches or directly into sloughs. The main source of sedimentation in the ditches and sloughs on the flats is soil eroded from agricultural fields (Bulthuis, 2013).

A tide gate regulates discharge and inflow water from each of these sloughs. Pumps may also be used to move water across the dikes and into the bay under high water conditions. The pumps also move freshwater out during low tide and prevent salt-water flow upstream into the sloughs during high tide. However, seawater does enter the sloughs by seepage through the dikes and tide gates (Skagit Conservation District and Padilla Bay Estuary Research Reserve, 2005). Salinity in the lower sloughs varies daily with the tidal cycle and seasonally. Salinity is lower during the wet season when rain and low tides bring freshwater to the mouths of the sloughs. During the dry season, salinity in the lower sloughs is often the same as Padilla Bay. The quantity of fresh waters discharged into Padilla Bay increases with rainfall. The amount of water discharged from the sloughs changes significantly during dry weather periods. Both

farmers and local staff monitoring water quality have said that even when some crops are irrigated, the sloughs often have very little to no flow by the end of summer. During drought or low flow conditions, the sloughs are sensitive to bacterial inputs. Decreased flows can lead to increased water temperatures and potentially stagnant waters, conditions that promote bacterial growth.

Joe Leary Slough--Priority Water Cleanup Segments

Joe Leary Slough is the largest of the sloughs in the eastern Padilla Bay watershed. Joe Leary flows through a primarily agriculture-dominated landscape, travelling briefly through a commercially developed area in northwest Burlington (JL8.9) and a mixed land use area in the middle of the subbasin (JL 4.7). Three dairies operate in the upper watershed along with pastures, feed corn, and a wide variety of row crops including potatoes, blueberries, strawberries, and broccoli (WSDA Cropland Data 2017).

Table 18 describes bacteria concentrations and compliance with state recreational bacteria threshold in Joe Leary Slough. Water quality exceeded both the geometric mean and not-to-exceed 10% statistical test value (STV)[4] during both the wet and dry seasons for the majority of sites, with all sites exceeding the STV during the wet season. A culvert draining into upper Joe Leary (JL8.9CU) had the overall highest geometric mean in both the wet and dry seasons.

The Skagit Stream Team collected data at four locations in Joe Leary Slough. Similar to Ecology findings, their data showed the headwaters have high loading values (multiple samples at the highest detectable value of 1,600 CFU). Stream Team Site ID JL1 (very near TMDL sample location JL11.25) and site JL2 (near TMDL site 8.9) frequently had the highest sample concentrations values in the 2016 - 2017 sample season, with only 4 of 17 samples testing at or below 100 cfu/100 mL.

In order to target the efforts in the areas of greatest need, the reductions necessary to meet WQS were calculated for each of the monitored reaches individually, as well as using a progressive reduction method. Seasonal precipitation, land use practices, and other variables affect the total bacteria levels (loadings) throughout the project area. For this TMDL, we will focus on reducing bacteria beginning with the headwater portions, or identified areas that have high bacterial loading. This will reduce bacteria moving downstream, which can reduce or eliminate the progressive loading effect.

Progressive bacteria reductions needed in Joe Leary Slough are shown in Figure **13** (wet season) and Figure **14** (dry season) to help visualize where pollution source identification and correction actions are needed. Each reduction number shows the percentage of bacteria that needs to be removed from a particular waterbody segment if the waters above it are meeting standards. During wet conditions, the upper reach of Joe Leary Slough starts out with high bacteria

[4] For compliance with not-more-than 10 percent criterion, 90th percentile levels determined using the log values of sample results (as done by the National Shellfish Sanitation Program (2003)) will be used as a screening tool. Where this conflicts with the Water Quality Standards, Ecology will use the state standard.

concentrations that need to be reduced by 71 percent. Assuming that the 71 percent removal is achieved, then the next downstream segment needs a smaller percentage (<11%) of bacteria removed. Varying levels of bacteria enter the slough in the areas between sample points at JL11.2, JL10.2, and JL9.0. About 66 percent of the bacteria reaching the mouth of Joe Leary Slough are being introduced between segments JL8.9 and JL4.7 JL. About 16 percent of bacteria in the watershed enter in the segment between JL0.7 and JL2.7.

Focus areas to reduce bacteria: Even when the waters of Joe Leary Slough meet recreational bacteria criteria, it contributes the largest percentage of bacteria entering Padilla Bay in the wet season (~65%) and the dry season (~83%). Thus, it is the most important subbasin for correction and control efforts. The upper reach of Joe Leary Slough and the waterbody segments associated with JL8.9, JL4.7, and JL11.2NO are priority areas for source identification and correction activities in the Slough. The area between site 7.9 and 4.7 is the highest relative contribution within the system, and is the largest area of loading within the boundaries of this TMDL.

Source Analysis: Potential pollution sources in these areas include: road run off, onsite septic systems located in close proximity to surface waters or drainage systems, livestock rearing facilities, and agricultural operations using livestock manure as an agricultural fertilizer. Other sources of bacteria may be from wildlife using area during migration or wintering, which may lead to localized loading in surface waters and ponds.

Samples taken at JL8.9 also show a high percentage of exceedances under all flow conditions. JL8.9 receives a combination of MS4 and agricultural drainage from upstream sources. Investigative samples collected in the MS4 areas have demonstrated high FC concentrations, which will require additional implementation efforts and stormwater control.

Table 18 - Fecal coliform results for Joe Leary Slough. Bold values indicate water quality exceedance. Geometric mean units are cfu/100 mL

Site	Annual (n)	Annual Geomean	Annual % Exc*	Wet Season (n)	Wet Season Geomean	Wet Season % Exc*	Dry Season (n)	Dry Season Geomean	Dry season % Exc*
JL11.25EA	17	38	**12%**	11	53	**18%**	6	20	0%
JL11.25NO	17	62	**29%**	11	95	**36%**	6	28	**17%**
JL11.2	23	66	**35%**	13	**105**	**38%**	10	36	**30%**
JL10.2	23	**217**	**65%**	14	**196**	**57%**	9	**256**	**78%**
JL9.0	20	**109**	**30%**	12	**133**	**33%**	8	82	**25%**
JL8.92CU**	22	**286**	**77%**	14	**234**	**71%**	8	**407**	**88%**
JL8.9	24	**149**	**38%**	14	**147**	**50%**	10	**151**	**20%**
JL7.9	23	**114**	**22%**	13	**101**	**15%**	10	**134**	**30%**
JLT6.2**	19	**107**	**32%**	12	88	**25%**	7	**149**	**43%**
JL4.7	23	**104**	**30%**	13	**126**	**46%**	10	81	10%
JL2.7	23	**108**	**13%**	13	**110**	**15%**	10	**105**	10%
JL0.7	23	**123**	**22%**	13	**102**	**15%**	10	**157**	**30%**

*Percentage of samples exceeding 90th percentile value of 200 cfu/100 mL; **Tributary site

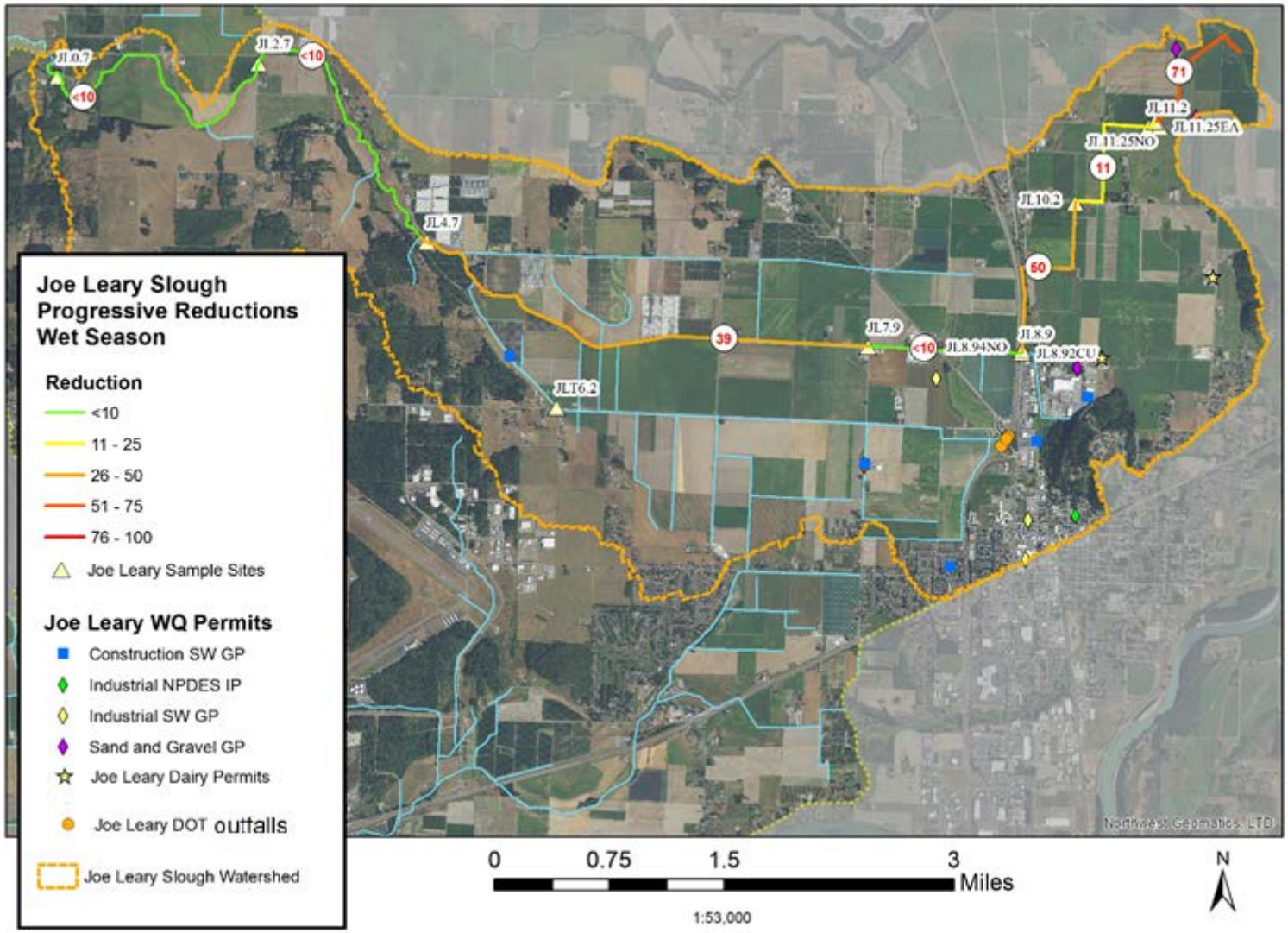


Figure 13 - Joe Leary Slough progressive reductions by reach during the wet season. Progressive reductions help us visualize where bacteria enter Joe Leary Slough.

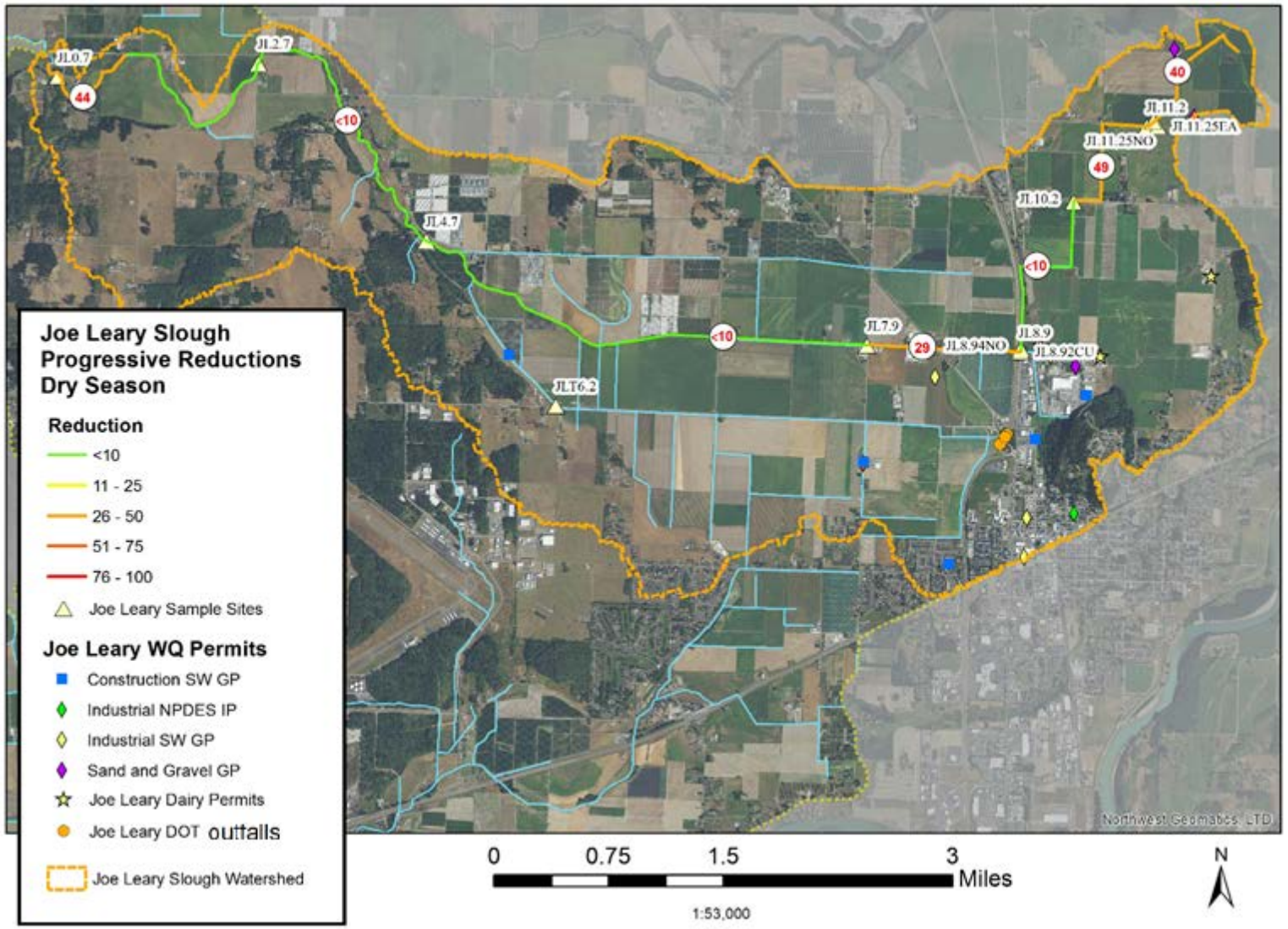


Figure 14 - Joe Leary Slough progressive reductions by reach during the dry season based on Table 6. Each reduction number reflects the percentage of bacteria that needs to be removed from a particular waterbody segment.

No Name Slough--Priority Water Cleanup Segments

For the purposes of the TMDL, No Name Slough includes both the low gradient watercourse, as well as No Name Creek. No Name Slough flows through an area that is mainly agricultural fields and smaller areas with rural housing and some industrial and commercial areas, including the Skagit County Regional Airport. The downstream reaches of No Name Slough are influenced by tides, and the lowest freshwater site sampled for this study is NN1.0. When the waters of No Name Slough meet state recreational contact criteria, it should be contributing less than 10% of the fecal coliform bacteria entering Padilla Bay in the wet season and even less (< 1%) in the dry season.

Due to low flows in the dry season, Ecology was unable to collect FC samples at most sites in No Name Slough. Only site NN1.0 was sampled both during the dry and wet seasons showing larger FC concentrations during the wet season. It met the geometric mean criterion calculated annually and was close to meeting it on a seasonal basis. However, 7 of the 17 wet weather samples exceeded the STV of 200 cfu/100ml. Main stem sites NN2.3, NN1.8, and NN1.0 had the highest FC concentrations, compared with tributaries, headwaters, and agricultural waterways (NNSJW, NNMHSE, NNT1.7, NNBVSE) that feed into the slough. During the wet season, NN2.3 and NN1.8 had the highest levels of FC, and 67 percent of samples from each site exceeded the 90th percentile value of 200 cfu/100 mL (Table 19).

The single dry season NN2.3 sample was not enough to analyze seasonal statistics, but the May sample had the highest FC concentration within the No Name Slough dataset (>1,600 cfu/100 mL). The low flow (0.68 cfs) during that time, however, resulted in a low FC load.

Table 19 - Fecal coliform results for No Name Slough. Bold values indicate water quality exceedance. Geometric mean units are cfu/100 mL.

Site	Annual (n)	Annual Geomean	Annual % Exc*	Wet Season (n)	Wet Season Geomean	Wet Season % Exc*	Dry Season (n)	Dry Season Geomean	Dry season % Exc*
NNSJW	6	80	**17%**	6	80	**17%**	0	Insufficient data	Insufficient data
NN2.8	12	91	**25%**	12	91	**25%**	0	Insufficient data	Insufficient data
NN2.3	13	**229**	**69%**	12	**197**	**67%**	1	Insufficient data	Insufficient data
NNMHSE	6	53	**17%**	6	53	**17%**	0	Insufficient data	Insufficient data
NN1.8	14	**182**	**64%**	12	**182**	**67%**	2	Insufficient data	Insufficient data
NNT1.7*	13	56	**15%**	10	89	**20%**	3	Insufficient data	Insufficient data
NNBVSE	6	80	0%	6	80	0%	0	Insufficient data	Insufficient data
NN1.0	17	87	**41%**	12	**103**	**50%**	5	58	**20%**

Percentage of samples exceeding 90th percentile value of 200 cfu/100 mL; **Tributary site

Progressive bacteria reductions needed in No Name Slough during the wet weather season are shown in Figure **15**. The upper reach of No Name Slough starts out with bacteria concentrations that need to be reduced by 43 percent during the wet season from the headwaters to sample point NN2.8. Loading continues below site NN2.8 requiring a 64% reduction upstream of NN2.3. Assuming that 64 percent removal is achieved, then the next downstream segment needs a smaller percentage (<10%) of bacteria removed (NN2.3 to NN1.8). Loading increases again from NN1.8 to NN1.0 where approximately 67 percent of the bacterial loading needs to be reduced.

As noted earlier, several of the upstream reaches were not sampled due to dry stream conditions. During the dry season, NN1.0 requires a 28 percent reduction in bacteria levels. The tributary with sample location NNT1.7 did not appear to be a source of significant loading. Of the 17 samples collected at NN1.8, 12 exceeded the water quality standards. Additionally, NN1 had three samples and NN2 had two samples that tested at the upper limit of the analytical method, with a TNTC (Too numerous to count) value of 1,600 cfu/100 mL. TNTC values generally underestimate the actual bacteria counts in a sample.

Ecology sampled No Name Slough during one heavy rainfall event (March 1, 2017) and observed the highest FC concentrations in agricultural waterways draining into the Slough near NN1.8 and NN2.3. Further discussion of these results are in Appendix G. Skagit Stream team's storm sampling results found the highest bacterial concentrations at site NN2.3 (Stream team site ID NN1) and NN1.8 (Stream team site NN2), similar to Ecology's regularly scheduled data collection.

Focus areas to reduce bacteria: FC reductions needed to achieve loading capacity and meet water quality standards for this study, show that the greatest reductions need to occur in the uppermost reaches (above NN2.3). While fixing upstream sources of FC in these stream stretches will improve water quality downstream, more FC reductions are needed between NN1.0 and NN1.8.

The most upper reach of No Name Sough and the waterbody segments associated with the headwaters to NN2.3, and again from NN 1.8 to NN1.0, are priority areas for source identification and correction activities in No Name Slough.

Source Analysis: Pollution sources in these areas include livestock rearing facilities, insufficient exclusion fencing, potential lack of proper manure management or storage, and industrial waste streams or stormwater. Bacterial loading may be entering the watercourse from failing onsite septic systems, or systems with insufficient drain fields located in close proximity to surface waters. Ongoing efforts from Skagit County, the Skagit Conservation District, and the Department of Ecology include working with property owners to improve site conditions and improve water quality. Other sources of bacteria may be from wildlife using area during migration or wintering, which may lead to localized loading in surface waters and ponds.

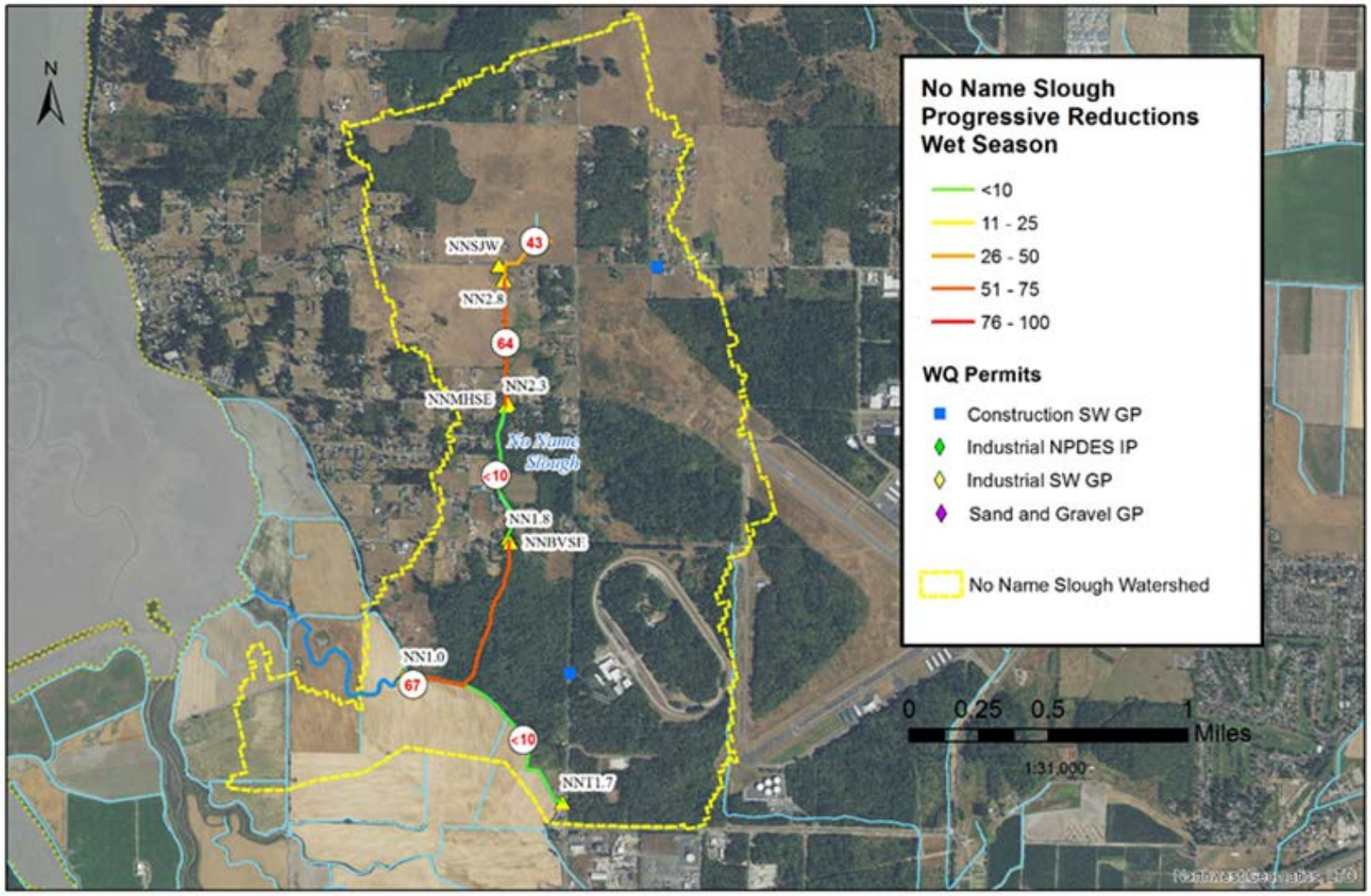


Figure 15 - No Name Slough progressive reductions. Each reduction number reflects the percentage of bacteria that needs to be removed from a particular waterbody segment.

Little Indian Slough--Priority Water Cleanup Segments

Little Indian Slough is the smallest of the sloughs in this study. It travels through a commercial and industrial developed area south of Bay View Ridge, and then through agricultural fields before flowing into the same outlet as Big Indian Slough. One freshwater site (LI1.9) was sampled both during the wet season and dry season. Bacteria levels were similar during both periods showing the same geometric mean (212 cfu/100 mL) and close STVs (Table 20).

Table 20 - Fecal coliform results for Little Indian Slough. Bold values indicate water quality exceedance. Geometric mean units are cfu/100 mL.

Site	Annual (n)	Annual Geomean	Annual % Exc*	Wet Season (n)	Wet Season Geomean	Wet Season % Exc*	Dry Season (n)	Dry Season Geomean	Dry season % Exc*
LI1.9	18	**212**	**50%**	13	**212**	**46%**	5	**212**	**60%**

*Percentage of samples exceeding 90th percentile value of 200 cfu/100 mL;

This site requires a large reduction of FC upstream to meet water quality standards in both the wet season (85 percent reduction; Figure **16**) and dry season (69 percent reduction; Figure **17**). Significant loading was not detected between LI0.7 and LI1.9, which is a predominantly agricultural portion of the tributary watershed. The upstream area that drains into LI1.9 is commercially developed, with the commercial/industrial facilities are permitted under Washington State Waste Discharge permits issued by the Department of Ecology.

Source Analysis: The industrial activities in this non-profit basin may inadvertently be sources of FC bacteria through storm water or leachate issues. Local industrial processing may also produce Klebsiella bacteria from lumber and wood processing. In the industrial areas, wildlife does congregate on some structures, which may lead to a localized source of bacteria. This suggests that FC pollution could be coming from nonpoint sources and may be reduced through additional stormwater control BMPs in this area. Other sources of bacteria may be from wildlife using area during migration or wintering, which may lead to localized loading in surface waters and ponds.

Ecology will continue to monitor and inspect this area with local partners, and will continue to work with permit writers to update permit language to correct the issue once the source(s) (if any) have been located.

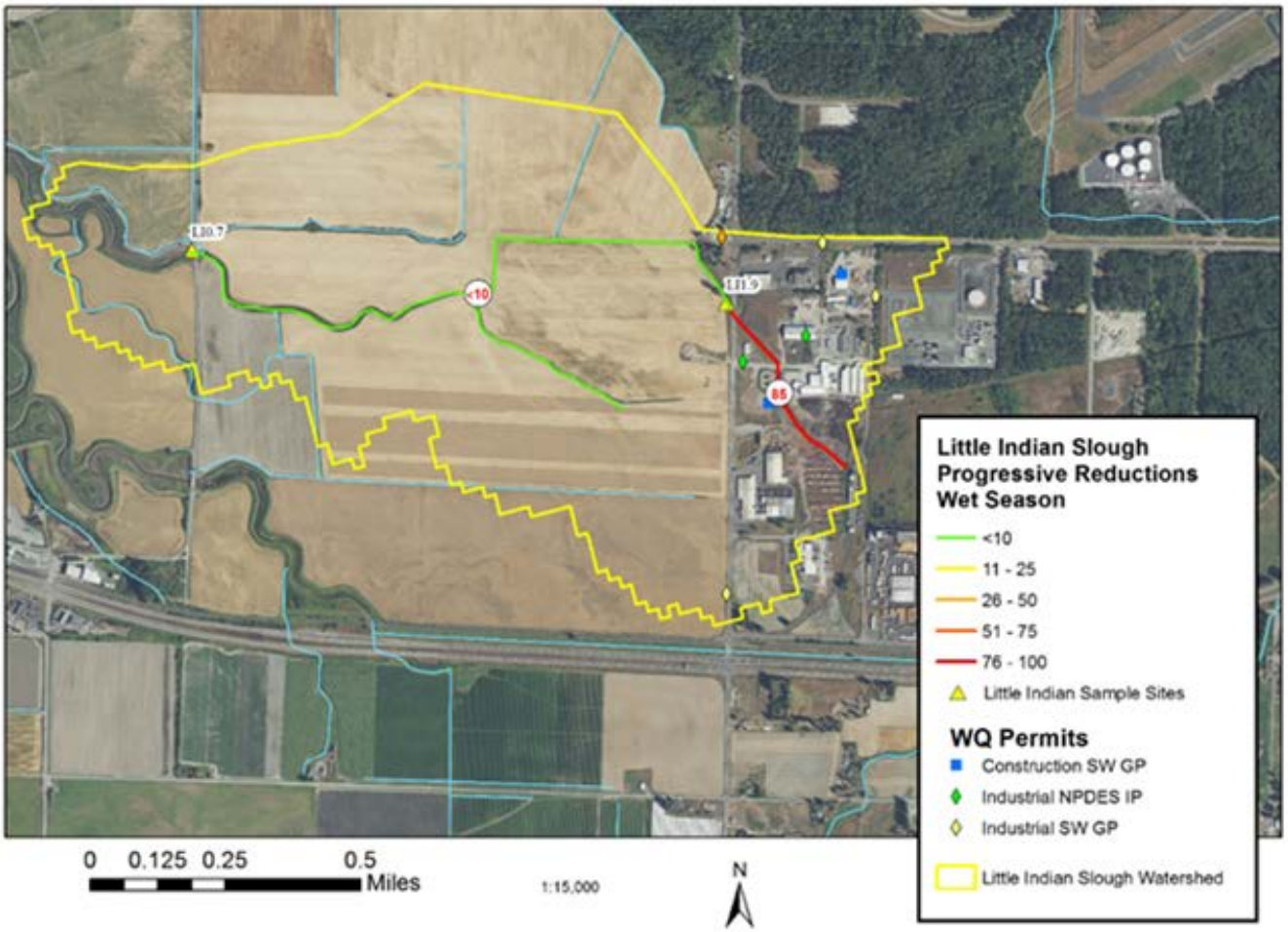


Figure 16 - Little Indian Slough progressive reductions during the wet season. Each reduction number reflects the percentage of bacteria that needs to be removed from a particular waterbody segment.

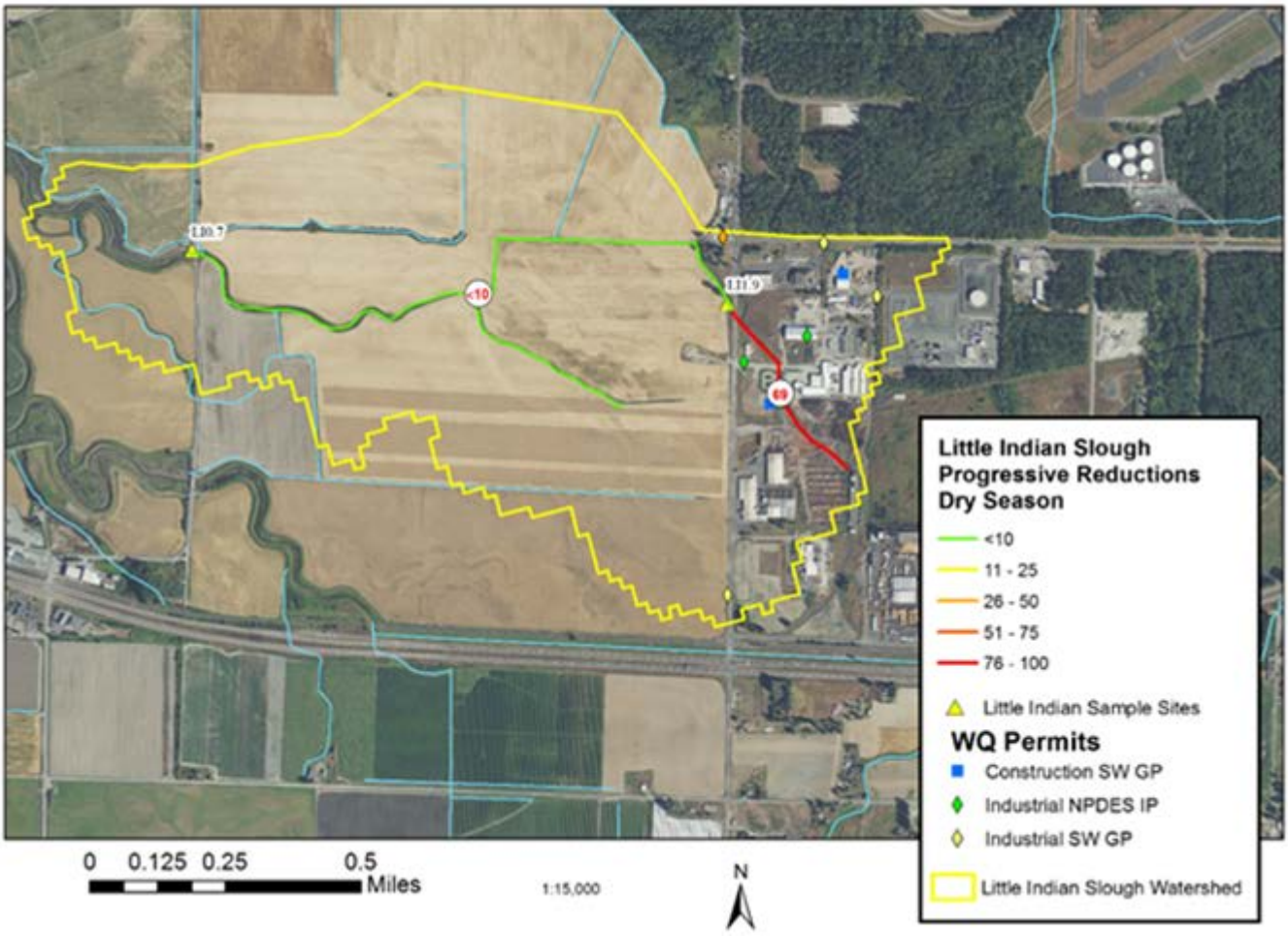


Figure 17 - Little Indian Slough progressive reductions during the dry season. Each reduction number reflects the percentage of bacteria that needs to be removed from a particular waterbody segment.

Big Indian Slough--Priority Water Cleanup Segments

Big Indian Slough flows adjacent to residential and other developed areas, including alongside Highway 20, before flowing through agricultural fields and outflowing at the confluence of the dike that drains into Padilla Bay. The drainage network in Big Indian Slough appears to connect to Higgins Slough, and may receive flow under wet season, high flow conditions. Potential flow paths were visited in the wet season after a storm event to try to quantify flow values, but proved unsuccessful. The TMDL tributary boundary for Big Indian is based on the NDH catchment data.

Under wet weather conditions Big Indian Slough should be contributing no more than 25% of the expected loading to Padilla Bay. In summer the basin should be contributing 17% or less of expected loadings. Although a much smaller contributor than Joe Leary Slough, Big Indian Slough needs significant bacteria reductions in both dry and wet weather periods.

During the wet season, 38 percent of samples at BI6.2 exceeded water quality standards (Table 21). While all sites met the water quality criterion for geometric mean, BI2.8 had the highest geometric mean. During the dry season, both BI8.2 and BI2.8 had over 10 percent of samples exceed standards, and FC concentrations were generally low in the middle reaches (BI6.2 and BI4.0).

For progressive reductions, the largest reductions needed to achieve water quality standards throughout the slough are upstream of BI6.2 during the wet season (63 percent reduction) and upstream of BI8.2 during the dry season (66 percent reduction) (Figure **18** and Figure **19**). As these reductions are met upstream, downstream conditions are expected to meet water quality criteria.

Table 21 - Fecal coliform results for Big Indian Slough. Bold values indicate water quality exceedance. Geometric mean unit is cfu/100 mL.

Site	Annual (n)	Annual Geomean	Annual % Exc*	Wet Season (n)	Wet Season Geomean	Wet Season % Exc*	Dry Season (n)	Dry Season Geomean	Dry season % Exc*
BI8.2	19	43	**16%**	12	42	8%	7	44	**29%**
BI6.2	21	41	**24%**	13	60	**38%**	8	22	0%
BI4.0	21	36	5%	13	52	8%	8	19	0%
BI2.8	23	65	9%	14	71	7%	9	57	**11%**

*Percentage of samples exceeding 90th percentile value of 200 cfu/100 mL;

Priority areas to reduce loading: The upper reach of Big Indian Sough and the waterbody segments associated with the headwaters (BI8.2 and BI6.2) are the priority areas for source identification and correction activities in Big Indian Slough. The area is a mix of agriculture and urban development.

Source Analysis: Potential pollutions sources in these areas include onsite septic systems located in close proximity to surface waters or drainage systems (MS4 or agricultural drainage), agricultural operations using livestock manure as an agricultural fertilizer, industrial stormwater/runoff, road/highway runoff, and. Other potential sources include a lack of pet waste disposal facilities or storm water control in the developed area. Other sources of bacteria may be from wildlife migrating or wintering in the area, which may lead to localized loading in surface waters and ponds. Ecology will continue to monitor and inspect industrial and permitted facilities in this area as necessary and will update permit language to correct the issue once a source or concern has been located.

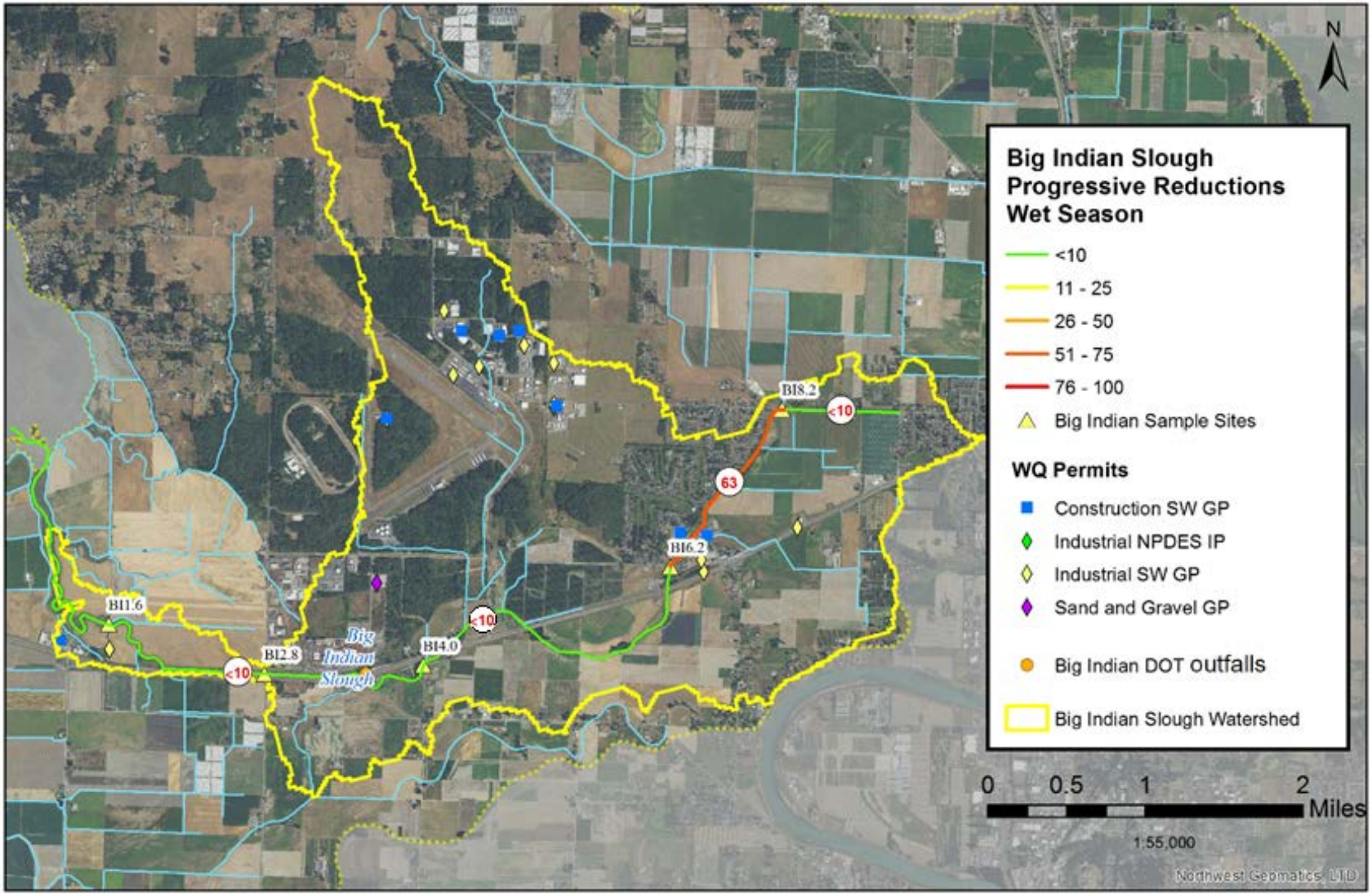


Figure 18 - Big Indian Slough progressive reductions during the wet season. Each reduction number reflects the percentage of bacteria that needs to be removed from a particular waterbody segment.

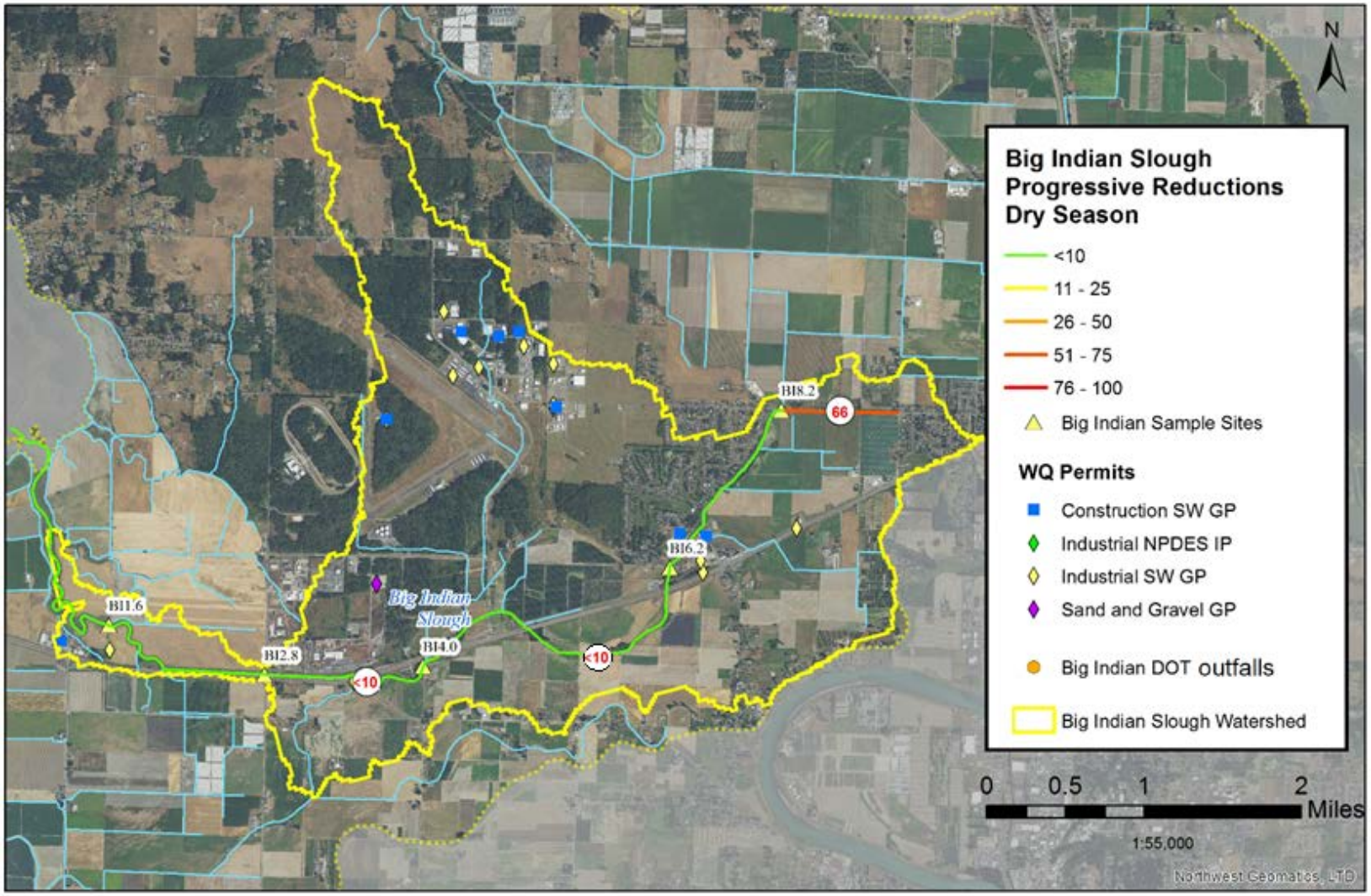


Figure 19 - Big Indian Slough progressive reductions during the dry season. Each reduction number reflects the percentage of bacteria that needs to be removed from a particular waterbody segment.

Bay View Outfalls--Priority Water Cleanup locations

Select Bay View outfalls were sampled throughout the study duration. These sample locations are taken from storm water outfalls. These direct stormwater outfalls are not state waters, and do not meet the criteria of being a "well-mixed receiving waterbody". Sample results are provided as information to assist in reducing bacterial pollution in the area, but are not used in TMDL values within this report.

This site's drain areas pass through the community of Bay View and flow directly into Padilla Bay. We were unable to evaluate each site on a seasonal basis due to insufficient sampling data (< 5 samples) and lack of flows during the dry season (Table 22). Based on the annual results, high FC concentrations were found primarily in the southern group of outfalls (BV9, BV10, BV11). These outfalls drain to a more developed landscape than the northern outfalls (Figure 20).

Ecology sampled select Bay View outfalls (BV8, BV9, BV10, and BV12) during a heavy precipitation event on October 26, 2016. All sites had high FC concentrations (>200 cfu/100 mL), with the highest concentration at BV10 (840 cfu/100 mL), indicating that these outfalls were transporting high levels of FC runoff during times of high flow. More details about this high precipitation event can be found in the "Eastern Padilla Bay Tributaries Fecal Coliform Bacteria Total Maximum Daily Load Study: Water Quality Study Findings[5]"

Table 22 - Fecal coliform results for Bay View outfalls. Bold values indicate water quality exceedance. Geometric mean units are cfu/100 mL.

Site	Annual (n)	Annual Geomean	Annual % Exc*	Wet Season (n)	Wet Season Geomean	Wet Season % Exc*	Dry Season (n)	Dry Season Geomean	Dry season % Exc*
BV1	7	10	0%	5	7	0%	2	Insufficient data	Insufficient data
BV2	8	63	0%	6	66	0%	2	Insufficient data	Insufficient data
BV3	6	5	0%	5	3	0%	1	Insufficient data	Insufficient data
BV9	9	74	**44%**	9	74	**44%**	0	Insufficient data	Insufficient data
BV10	11	**201**	**36%**	9	**130**	**22%**	2	Insufficient data	Insufficient data
BV11	6	85	**17%**	4	Insufficient data	Insufficient data	2	Insufficient data	Insufficient data
BV12	9	29	**11%**	7	28	**14%**	2	Insufficient data	Insufficient data

*Percentage of samples exceeding 90th percentile value of 200 cfu/100 mL

[5] https://fortress.wa.gov/ecy/publications/documents/2003001.pdf

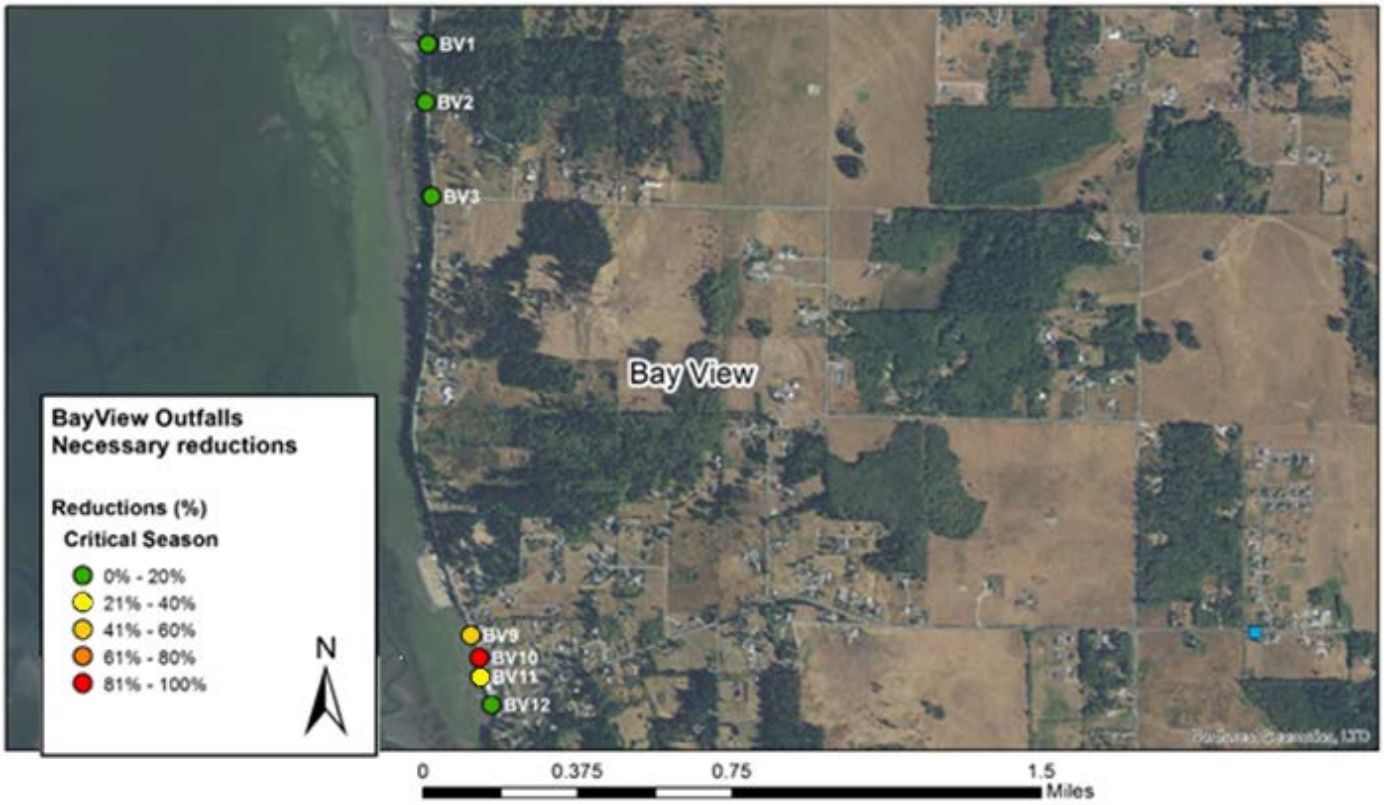


Figure 20 - Map of Bay View Outfalls that drain directly into Padilla Bay.

The Skagit Storm Team sampled at four locations within the Bay View area finding generally lower concentrations than Ecology's sampling efforts. Only one sample exceeded concentrations of 200 cfu/100 mL. Based on the differences between the sample results, additional source identification efforts are necessary.

Point Sources of Pollution

Urban stormwater in the Padilla Bay watershed may contribute to fecal coliform bacteria pollution within the TMDL area and is regulated by the Ecology permitting process. Major general permits in the study area include municipal stormwater, sand and gravel, construction stormwater, and industrial stormwater. Ecology expects fecal coliform discharges from the sand and gravel as well as the construction stormwater facilities to be very low.

We reviewed NPDES general and individual permits within the TMDL boundaries. Based on permit thresholds and fact sheets for individual permits, no permitted facility should be a source of fecal coliform bacteria. However, samples collected downstream of industrial areas do indicate significant bacterial loading near industrial sites in Little Indian slough, and potential loading in Big Indian Slough. Ecology staff will work to determine the sources of the bacterial pollution and address site conditions and (may) amend permit language as necessary.

The Phase II Municipal Stormwater Permit for Western Washington[6] (Phase II WWSP) applies to medium and small municipalities where the stormwater conveyance system is within a census-urbanized zone or Urban Growth Area of a county. This permit provides coverage for portions of the Bayview Ridge (Urban Growth Area), Skagit County Phase II, and of the City of Burlington. Drainage District 19 and the Port of Skagit are also included as secondary permittees. The Phase II Municipal Stormwater permit requires permit holders to address the following federal requirements:

1. Public education and outreach (Figure 26)
2. Public participation/involvement
3. Illicit discharge detection and elimination
4. Construction site runoff control
5. Post-construction runoff control
6. Pollution prevention/good housekeeping
7. Implementation of applicable TMDLs
8. Program evaluation and reporting

The permittees must use all known, available, and reasonable methods of prevention, control and treatment (AKART) to prevent and control pollution of waters of the State of Washington. Additionally, the permittees must reduce the discharge of stormwater pollutants to the maximum extent possible (MEP), the Federal standard required of all MS4 permittees.

Compliance with the municipal stormwater permit is measured by the permittee's successful implementation of programs and requirements described within the permit. This TMDL expects basic permit conditions will help permittees control much of the FC bacteria discharged to the Padilla Bay watershed. Additional TMDL-related MS4 permit conditions are discussed in the Required and Recommended Actions section below.

Stormwater discharges from Washington State Department of Transportation (WSDOT) highways and facilities are covered by the WSDOT Municipal Stormwater Permit.[7] WSDOT permits cover highway systems running through the study area, and these include Interstate Highway 5 (I-5), Washington State Route 11, State Route 20, and State Route 536. Additional details of the calculations, including all permits in the area as well as calculated runoff and loading, are located in Appendix I. This TMDL expects that implementation of existing WSDOT permit conditions will control much of the FC bacteria discharged from WSDOT highways and facilities to comply with assigned WLAs in the Padilla Bay watershed Additional TMDL-related MS4 permit conditions are discussed in the Required and Recommended Actions section below, and draft language has been submitted to WSDOT and Ecology permit managers for review.

[6] https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Stormwater-general-permits/Municipal-stormwater-general-permits#phaseii

[7] https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Stormwater-general-permits/Municipal-stormwater-general-permits/WSDOT-Municipal-Stormwater-Permit

Nonpoint Sources of Pollution

This chapter of the implementation plan provides general information on these sources and ways to fix them. For agricultural pollution sources, Ecology is currently working with the state Agriculture and Water Quality Advisory Committee[8] to develop Voluntary Clean Water Guidance for Agriculture.[9] That guidance is expected to be completed over the next few years. Agricultural landowners and local conservation districts should consider the guidance as a future resource to be used in combination with other established information to guide site-specific implementation efforts.

Onsite Septic Systems

Onsite septic systems (OSS) are a potential source of bacteria and nutrient pollution to the Padilla Bay tributaries when they are poorly sited or designed or when property owners do not properly operate, monitor, and maintain them. Without proper maintenance, the performance, effectiveness, and life expectancy of the system may be drastically reduced. Reduced effectiveness or system failure can lead to direct discharge of high quantities of bacteria and result in a direct human health threat due to the potential presence of harmful pathogens. Connecting septic systems to stormwater sewers or piping them directly to surface waters is occasionally discovered and is illegal. Another problem observed in some older septic systems is the subsurface movement of wastewater through extremely porous soils or subsurface diversion of wastewater in curtain drains[10].

A properly functioning OSS uses drain field soils to remove bacteria and some nutrients from the wastewater. However, upper soil compaction, clogging of the underlying soil with solids, and hydraulic overloading can all cause a failure of the system to adequately treat wastewater (Figure 21). Signs of OSS failure include:

[8] https://ecology.wa.gov/About-us/Our-role-in-the-community/Partnerships-committees/Agriculture-and-Water-Quality-Advisory-Committee

[9] https://ecology.wa.gov/About-us/Our-role-in-the-community/Partnerships-committees/Voluntary-Clean-Water-Guidance-for-Agriculture-Adv

[10] Curtain drains are narrow trenches filled with gravel covering perforated pipe that drain wet soils.

Figure 21 - Property owners see signs of septic system failure (Washington Department of Health)

Water and sewage from toilets, drains, and sinks are backing up into the home.

- Bathtubs, showers, and sinks drain very slowly.
- Gurgling sounds in the plumbing system.
- Standing water or damp spots near the septic tank or drain field.
- Bad odors around the septic tank or drain field.
- Bright green, spongy lush grass over the septic tank or drain field, even during dry weather.

The Skagit County Public Health Department (SCPHD) has authority under Revised Code of Washington (RCW) to administer regulations regarding public health and onsite sewage programs in the County. Per the Skagit County Health Department Website:

> *Washington State code and Skagit County Code require that all septic systems go through site evaluation, design review and approval, and permitting prior to installation. After the system is installed, a final inspection is done by County staff. These requirements assure that systems are designed and installed appropriately at each location to prevent pollution.*

The SCPHD has an ongoing outreach, inspection, and compliance effort and is proactively contacting septic owners within the watershed.

Required actions: All OSS owners/operators should regularly maintain their systems. Complete information on how homeowners should maintain their OSS can be found on the Skagit County website.[11] The SCPHD helps OSS owners understand when inspections are needed and provides both maintenance tips and a list of qualified OSS maintenance providers. Should significant OSS repairs or replacement ever be needed, low interest loans are available through SCPHD's partnership with Craft 3[12]. The SCPHD should continue to lead residential and small OSS education, outreach, technical assistance, and compliance actions in this TMDL area.

Livestock Management

Livestock are important to the lives of many Washingtonians. Whether you raise cattle, dairy cows, sheep, alpaca, or equestrians, the practices to prevent water pollution problems are largely the same. Livestock owners must prevent animal access to local water bodies and prevent manure from entering surface waters, including ditches, streams, and rivers.

Ecology staff are working with an advisory group to research and write the Voluntary Clean Water Guidance for Agriculture. The guidance is a technical resource for agricultural producers that describes Ecology's recommended BMPs to protect water quality. It is intended to support healthy farms while helping producers meet clean water standards. While this document is still in development, Ecology plans to release 13 chapters of this guidance over the next two to three years (2022 – 2023). Skagit County has also developed a BMP assessment tool through its Pollution identification and Correction (PIC) program. This tool is useful in evaluating what additional practices may be beneficial in reducing pollution, and all practices are based on the Natural Resource Conservation Service (NRCS) Field Office Technical Guide.

Skagit County and Ecology nonpoint staff are the point of contact for water quality problems associated with most livestock operations, with the exception of dairies. Dairies are co-managed with the Washington State Department of Agriculture (WSDA). Under Chapter RCW 90.64, WSDA is the lead agency administering the Dairy Nutrient Management Act Washington's Dairy Nutrient Management Act requires all licensed cow dairies to develop and implement nutrient management plans, register with WSDA, and participate in a program of regular inspections and compliance.

Ecology works in partnership with WSDA administering the Concentrated Animal Feeding Operation (CAFO) General Permit. The CAFO permit is issued to certain operations that confine livestock in pens or barns for 45 days or more during the year and discharge pollution to surface or groundwater. Ecology writes and issues permits to CAFOs while WSDA performs inspections, provides technical assistance, and initiates most compliance activities associated with the permit. Additional information regarding the permit and application process can be found on the Ecology CAFO webpage.[13]

[11] https://www.skagitcounty.net/Departments/HealthEnvironmental/onsitesewer.htm
[12] https://www.craft3.org/About/Mission
[13] https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Concentrated-animal-feeding-operation

The Skagit Conservation District provides non regulatory assistance and technical services, and can act as a link between cooperators and government agencies in order to promote and implement technical and financial assistance programs to conserve natural resources. All services provided by the SCD are voluntary and free of charge.

Several practices refer to NRCS practice standards. NRCS practice standards provide guidance to a variety of livestock operations and field practices, but do not apply to all operations and practices. If existing regulations and requirements do not apply, manure and livestock nutrients should be stored in systems and structures that meet NRCS construction standards.

Manure management: Spreading and incorporating manure into agricultural fields is a common practice that supplies nutrients to croplands. However, without proper management, the rate, timing, and location of applications may adversely affect water quality and the health of downstream animals. Manure should not be applied close to waterways, during or in the days before large rainstorms that could lead to runoff, or on flooded fields to prevent conditions where fecal coliform runoff could enter ditches, stream, rivers, and lakes. Where downstream livestock use local waters for drinking, the risk to animal health and profits are at increased risk.

The proper storage of manure is important to ensure it will be both useful as a beneficial nutrient and to prevent it from polluting local waters. Manure should be managed in well maintained, engineered lagoons or storage tanks the meet NRCS standards or waste storage facilities that have a permanent roof, curbed concrete floor, and gutters and downspouts to divert clean water away from stored waste. Waste storage facilities should be located in areas where diverted water will not impact surface waters by concentrating flow via steep slopes or creating preferential flow paths. Efforts to store any manure away from a watercourse or potential drainage path is critical for both large-scale industrial operations and non-industrial farm residences (Figure **22**).

Figure 22 - Photo of an example of proper management practices used by a horse owner.

Dry manure storage guidance:

- Livestock manure within confinement areas and horse paddocks should be collected, stored, composted and utilized in a manner that prevents contamination of State waters. Dry manure should be stored and composted in appropriately constructed manure management facilities. Manure management facilities should be set back a minimum of 100 feet from all surface waters unless it can be demonstrated to Ecology's satisfaction that there is no suitable site more than 100 feet from surface waters. In the latter case, Ecology should approve a design plan to prevent contamination of State waters.
- Manure collection, storage, and composting areas should never be constructed directly above or within a 100-foot horizontal distance of any surface inlet, manhole, or vent to subsurface drainage. This includes small-diameter tile in-field drainage, as well as large-diameter collector drains, that are completely buried.
- Manure storage facilities should be designed to provide adequate storage for all manure generated by the operation, be covered, and installed on an impermeable surface.
- All manure collection, storage, and composting areas should be sited away from locations that will concentrate runoff or increase the potential for polluted runoff to reach perennial surface waters such as steep slopes, unstable or erodible soils, natural or constructed drainages, or topography that concentrates runoff.
- Clean water should be diverted from entering manure collection, storage and composting areas through the use of gutters, berms, roofs, or other means of conveyance to prevent contact with manure. All manure should be utilized in a manner that prevents contamination of State waters.

Wet manure storage guidance:

- Livestock manure should be collected, stored and utilized in a manner that prevents contamination of State waters. Liquid manure should be stored in appropriately designed and constructed waste storage lagoons. Manure storage lagoons should be set back a minimum of 100 feet from all surface waters unless it can be demonstrated to Ecology's satisfaction that there is no suitable site more than 100 feet from surface waters. In the latter case, Ecology should approve a design plan to prevent contamination of State waters.
- Manure storage lagoons should never be constructed directly above or within a 100-foot horizontal distance of any surface inlet, manhole, or vent to subsurface drainage. This includes small-diameter tile in-field drainage, as well as large-diameter collector drains, that are completely buried.
- Manure storage lagoons should be designed to provide adequate storage based on the volume of liquid manure generated by the operation, as well as for the local area's 25-year, 24-hour storm event volume. All liquid manure should be utilized in a manner that prevents contamination of State waters.

Lagoons should be designed, constructed, and maintained following the guidance provided by NRCS Field Office Technical Guidance. State and local guidance should also be considered to be protective of water quality standards, or local sensitive or protected features.

- Clean water should be diverted from entering manure storage lagoons through the use of gutters, berms, roofs, or other means of conveyance to avoid unnecessary storage of clean water as well as prevent contact of storm water with manure in production areas.
- All liquid manure should be utilized in a manner that prevents contamination of State waters. Application of liquid manure to fields should be consistent with the Nutrient Application BMPs listed below in the section labeled Cropland Practices.

Nutrient (manure) application guidance:

- No nutrients should be applied within riparian buffers or buffer zones.
- All sources of nutrients should be accounted for when determining recommended application rates for crops. Nutrient applications should be based on soil testing by field prior to application. Nutrient applications rates should be commensurate with crop growth patterns, and consistent with the nutrient management plan for the farm. To prevent surface or leaching losses, nutrients should only be applied to growing crops. Nutrients should only be applied in a manner that limits waste, prevents surface runoff losses and subsurface leaching beyond the root zone of the crop.
- In no event should runoff occur when using any nutrient application method, including runoff into subsurface drainage through inlets, vents, and manholes.
- Nutrients should not be applied between November 1 and February 1. Nutrients should not be applied: to saturated, frozen or snow-covered soils, to flood prone areas during seasons when flooding or inundation is likely, or within 48 hours of a forecasted precipitation event.

Exclusion Fencing: Exclusion fencing in combination with adequate vegetated filter strips are needed wherever livestock can access surface waters. Where livestock have direct access to waterways water quality is adversely affected by direct inputs of manure, which increase bacteria and nutrient levels in the surface waters onsite and downstream. It is also important for controlling access to seasonally wet pastures or to prevent overgrazing. This includes non-commercial livestock, such as individual horses, chickens, or other small scale farming animals, which do not require any permitting based on the low animal density/populations.

Exclusion fencing should be set back at a sufficient distance from stream banks, watercourses, and wetlands to establish a vegetated buffer. In cases where riparian vegetation is left unprotected from trampling and overgrazing by livestock, increases in water temperature, turbidity/suspended sediments, nutrients, and bacteria and decreases in dissolved oxygen and altered pH values are often observed (Sheffield et al. 1997; Belsky et al. 1999). The damaged stream banks are subject to additional sloughing or bank failures, further degrading instream habitat and negatively impacting property owners.

The buffers created by the exclusion fencing shield the stream from the impact of livestock by acting as filters, slowing runoff and increasing absorption of excess nutrients and contaminants into the soil (Figure 23).

Exclusion fencing guidance:

- Landowners should install exclusion fencing to prevent livestock access to all riparian buffers. Livestock should be excluded from flooded and flood-prone areas during periods of saturation. The use of hardened stream crossings should be used for all livestock movement across the riparian zones. Water gaps, with hardened access, may be used to water livestock in range pastures (not animal confinement or feeding areas).

Figure 23 - Example of exclusion fencing on Woods Creek, before and after implementation

Once exclusion fencing is established within a pasture area, a watering facility or device may need to be installed to provide water necessary for livestock. Depending on availability and site necessity, cost share dollars may be available to help offset the expense of the equipment or installation through local, state, or federal programs.

Other best management practices (BMPs):

Manure management and exclusion fencing BMPs may need to be used in combination with other practices to ensure surface waters are protected.

Common BMPs include pasture rotation and cross-fencing, barn gutters and downspouts, and heavy use area protection. Use of cover crops may also be useful for increasing water retention, increasing infiltration, and decreasing overland runoff. Heavy use area protection stabilizes ground surfaces that are frequently and intensively used by people, animals, or vehicles. These methods provide a stable, non-eroding surface that prevents erosion and polluted run-off from reaching a watercourse. Heavy use area-protection is especially important to prevent pasture damage during winter months or to prevent mud and runoff around a watering location.

Heavy Use Protection (HUP) guidance:

- Animal confinement and feeding areas should be set back a minimum of 100 feet from all surface waters unless it can be demonstrated to Ecology's satisfaction that there is no suitable site more than 100 feet from surface waters. In the latter case, Ecology must approve a design plan to prevent contamination of State waters.
- A 100-foot buffer zone should be established around all surface inlets and vents to subsurface drainage that are located within the boundaries of the animal confinement and feeding areas.
- All animal confinement and feeding areas should be sited away from locations that will concentrate runoff or increase the potential for polluted runoff to reach perennial surface waters such as steep slopes, unstable or erodible soils, natural or constructed drainages, or topography that concentrates runoff.
- All animal confinement areas should be hardened (stabilized) with compacted gravel, concrete, or similar material to allow for effective manure collection and to prevent erosion.

All livestock owners must prevent manure from reaching local surface waters. Primary technical assistance is available from the Skagit Conservation District in partnership with Ecology and WSDA (dairies only) as needed. BMPs that should be evaluated for all facilities including; waste storage facilities, exclusion fencing in combination with vegetated filter strips, gutters and downspouts, pasture management, and pasture rotation. Livestock owners should inquire about cost-sharing and grant opportunities to help with the cost of essential BMPs to protect water quality.

Proper manure management is especially important at dairies given the large amount of manure generated and its regular use as a nutrient and soil amendment. The Padilla Bay watershed has multiple dairy operations that operate under the Dairy Nutrient Management Act. None of the facilities are currently regulated under the CAFO permit. Ecology, Skagit Conservation District, and other partners should work with WSDA to address dairy sources as needed. Priority actions include close review of manure application practices, including adherence to appropriate application setback, verification of proper use of exported manure, and prevention of animal access to local waters.

Cover crops also have the potential to provide multiple benefits in within the TMDL area. They can prevent soil and wind erosion, improve soil's physical and biological properties, supply

nutrients, improve the availability of soil water, increase water retention/transpiration, and reduce overland flow. Many of these benefits will also potentially reduce bacterial loading by reducing runoff from areas when manure has been applied before the installation of the cover crop. Guidance related to cover crops is currently being developed with the "Voluntary Clean Water Guidance for Agriculture" document. Additional information resources and tools related to cover crops have been developed by the NRCS, and are available on the NRCS Cover Crop and Soil Health website[14].

Riparian vegetation and Forested Buffers

For the purposes of this TMDL, vegetated buffers are intended to act as a filter strip to increase water infiltration, reduce sediment transport, and reduce pollution. Although this TMDL focuses on reducing bacteria levels, implementation efforts should be also designed to be fully protective of water quality. In many cases, BMPs to control bacteria levels do not protect local waters for all beneficial uses

In order to fully protect water in the Padilla Bay Tributaries and support the beneficial use of salmon spawning, migration, and rearing, forested riparian buffers are recommended. Forested buffers are known to reduce overland flow and bacterial loading, as well as reduce water temperatures (which may have a secondary benefit of reducing bacterial survivability and/or regrowth). Landowners should consider the additional benefit to both livestock (shade provided to increase animal comfort) as well as local fish and invertebrates when making decisions on buffer size and plant composition.

Protective buffer widths can be found on Ecology's Riparian Buffer Width Map[15] and are summarized below. This TMDL recognizes that there is ongoing discussion related to the proper classification of the watercourses in the Padilla Bay area and any future changes may affect the fully protective buffer width in various portions of the tributaries.

Ecology's Water Quality Program recognizes the efforts of drainage districts and local landowners to work in partnership with NOAA, WDFW, and other Ecology representatives in the Drainage and Fish Initiative and Tidegate and Fish Initiative[16]. These efforts integrate salmon recovery priorities into drainage maintenance mitigation activities in surface waters recognized as managed waterbodies that serve important flooding and agricultural production needs in addition to the beneficial uses set out in our state's Water Quality Standards.

[14] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/climatechange/?cid=stelprdb1077238
[15] https://waecy.maps.arcgis.com/home/webmap/viewer.html?webmap=d5478a4aaf704d81bac63ffc934e1549
[16] https://www.westag.org/skagit-tidegate-and-fish-initiative

Riparian Buffer guidance:

- For ephemeral streams, install a minimum 35-foot wide riparian buffer, measured horizontally from the top of the streambank.

  The buffer should include the reestablishment of streamside vegetation sufficient to filter out pollutants before they reach the stream, and to stabilize stream banks. The buffer width may be increased, if needed.

- For intermittent streams, install a minimum 35-foot wide riparian buffer, measured horizontally from the top of the streambank. The buffer should include the reestablishment of streamside vegetation sufficient to filter out pollutants before they reach the stream, and to stabilize stream banks. The buffer width may be increased, if needed.

- For perennial water courses classified as rivers or streams, install a minimum 100-foot wide (50 feet wide, if non-fish bearing) riparian buffer, measured horizontally from the top of the streambank.

Stormwater Treatment

When rain and snow produce water that does not infiltrate or evaporate where it falls it creates stormwater. Stormwater flows naturally over land, or is conveyed in ditches and pipes, to local surface waters (Figure 24). As this water travels from land to streams it can pick up bacteria not only from poorly managed livestock facilities but also from parking lots, roads, streets, and roofs in the urban and suburban portions of Skagit County.

Figure 24 – Example of a marked stormwater drain.

Bacterial loading from stormwater was studied in two marine inlets of Puget Sound (Sinclair and Dyes Inlets near Bremerton). Ambient and storm event sampling determined that 26 stormwater outfalls from urban and commercial areas discharged bacteria at an overall geometric mean concentration of 947 cfu/100 mL compared with 321 cfu/100 mL for three

outfalls in rural areas and 140 cfu/100 mL for four outfalls in suburban developments (May et al., 2005). In urban areas around Puget Sound and other parts of the U.S., bacteria concentrations in stormwater can range from approximately 1,000 to over 100,000 cfu per 100 mL (Varner, 1995; Pitt, 1998).

Bacteria in stormwater may come from pet and other animal waste, surfacing wastewater from failing septic systems, other wildlife, and illicit or inadvertent cross connections with sewer systems. Stormwater pollution that drains directly to a stream or another natural water body without the help of pipes or ditches is considered nonpoint stormwater runoff and is not managed by an Ecology permit.

Recommended actions: Incorporating low impact development (LID) practices can help manage and mitigate stormwater impacts. LID involves land planning and design approaches to manage stormwater runoff and use of on-site natural features to protect water quality and increase water retention/detention. LID goals should include limiting any disturbance of a hydrologic processes to pre-development conditions. This is often done through the emphasizing of conservation, site planning, and distributed stormwater management practices that are integrated into a project design, such as rain gardens, permeable pavements, roof downspout controls, dispersion, soil quality and depth, vegetated roofs, minimum excavation foundations, and water re-use. LID practices can also be retrofitted in existing developed areas to reduce stormwater runoff.

Domestic pets

Domestic animal waste can be a significant contributor to bacterial loading. In general, bacterial loading from pets is of greater concern in urbanized areas, or at public recreation areas utilized for pet exercise.

There are several activities that pet owners can do to reduce or eliminate pollution associated with pet waste:

- Picking up their pet's waste using a plastic bag, scoop or disposable gloves when exercising pets. Pet waste bags may be provided in some public areas.
- All waste disposal should involve sealing the waste inside a plastic bag and throwing it in the garbage.
- Keeping dog poop out of septic systems and sewer systems. These systems are designed for human waste only.
- Picking up after their dogs in their yards every few days—more often if they have small children who play there.
- Owners should not place pet waste in compost piles. Pet waste left on the ground or put in a compost pile can contain harmful organisms. Most compost piles do not get hot enough to kill the bacteria and other organisms in dog and cat waste.

Figure 25 - Pet waste sign located in Bay View State Park, Padilla Bay.

Public outreach and education efforts (Figure 25) will be a major tool in changing public behavior and opinion on picking up and disposing of pet waste. Pet waste stations/bags are already available in several public areas.

Required and recommended actions: Installation and maintenance of pet waste stations at appropriate public properties or areas with existing trail systems. Continued outreach and education efforts, including both general information and targeted outreach to pet owners.

Human Sources Due to a Lack of Toilet Facilities

Portions of the watershed are popular destinations for outdoor recreation (e.g., areas used by hunters, anglers, boaters, and other recreationalists). Due to the lack of restroom facilities in these areas, it is likely that bacteria from human waste is entering nearby watercourses.

Evidence of direct human defecation near creeks has been observed and reported within Skagit County. Direct human contributions are likely to be concentrated in urban areas with higher densities of homeless residents, but may also occur in parks and greenbelts without restroom facilities regardless of the presence of homeless residents.

The use of temporary facilities or construction of permanent facilities should be evaluated for potential benefit. Future maintenance and costs benefit should be considered before implementation.

Required Actions: No specific areas of concern regarding unregulated human waste sources was identified as part of this TMDL study.

Local implementation partners should work with SCPHD and City governments to evaluate the best way to address these sources when they are discovered.

Waterfowl and Other Wildlife

Non-migratory and migratory birds have a presence in the watershed, and it is noted that birds and other wildlife may congregate in areas such as open crop fields and, as such, contribute locally to elevated counts (Swanson 2009). Ecology does not consider fecal coliform loadings from warm-blooded animals in natural numbers to be a pollution source. However, given the significant alterations of the natural environment to facilitate industrial and agricultural production, human activities can lead to high animal densities that contribute excessive amounts of bacteria to local waters.

Several migratory bird species utilize the lands and waters of the Padilla Bay watershed as part of their lifecycle. The brant, or brent goose (Figure **26**) that starts arriving in Padilla Bay in November, peaking numbers in April, and are typically gone by June (Bulthuis, 2013). About 10,000 Trumpeter and Tundra swans, 100,000 snow geese, and thousands of mallard and other dabbling ducks use Skagit farmland for food and habitat (WSU, 2014).

Figure 26 - Male Brant goose, often found in the area.

Bacteria from waterfowl and wildlife feces can wash into ditches and streams from fields with no buffers or where drainage or infrastructure provide a direct conduit to watercourses. While wildlife is not a specific target of reduction in this TMDL, any areas where stormwater is potentially conveying the elevated bacteria may be subject to BMPs.

Required actions: Areas where unnaturally high concentrations of wildlife congregate should be evaluated for BMPs that control and/or contain bacteria discharges. Areas of potential concern include agricultural fields that provide large amounts of forage and man-made

structures (like warm industrial roofs) that concentrate and increase wildlife levels far beyond natural levels. Proper garbage and waste storage and management should be used to prevent animal scavenging. Do not encourage wildlife by feeding or leaving food for them.

Forest Practices

The state's forest practices regulations will be relied upon to bring waters into compliance with the load allocations established in this TMDL on private and state forest lands. This strategy, referred to as the Clean Water Act Assurances, was established as a formal agreement to the 1999 Forests and Fish Report[17].

The state's forest practices rules were developed with the expectation that the stream buffers and harvest management prescriptions were stringent enough to meet state water quality standards for temperature and turbidity, and provide protection equal to what would be required under a TMDL. As part of the 1999 agreement, new forest practices rules for roads were also established. These new road construction and maintenance standards are intended to provide better control of road-related sediments, provide better stream bank stability protection, and meet current BMPs.

To ensure the rules are as effective as assumed, a formal adaptive management program was established to assess and revise the forest practices rules, as needed. The agreement to rely on the forest practices rules in lieu of developing separate TMDL load allocations or implementation requirements for forestry is conditioned on maintaining an effective adaptive management program.

Consistent with the directives of the 1999 Forests and Fish agreement, Ecology conducted a formal 10-year review of the forest practices and adaptive management programs in 2009[18].

Ecology noted numerous areas where improvements were needed, but also recognized the state's forest practices program provides a substantial framework for bringing the forest practices rules and activities into full compliance with the water quality standards. Therefore, Ecology decided to conditionally extend the CWA assurances with the intent to stimulate the needed improvements. Ecology, in consultation with key stakeholders, established specific corrective milestones for program accomplishment and improvement. These corrective milestones were designed to provide Ecology and the public with confidence that forest practices in the state will be conducted in a manner that does not cause or contribute to a violation of the state water quality standards.

In 2019 Ecology granted a two year extension to the Assurances (until December 31, 2021). This extension was provided to give time to address deficiencies in the rules to protect small non-fish-bearing headwater streams that were identified in several research studies through the adaptive management process.

[17] www.dnr.wa.gov/Publications/fp_rules_forestsandfish.pdf
[18] https://fortress.wa.gov/ecy/publications/SummaryPages/0910101.html

In order to extend the Clean Water Act Assurances beyond 2021, Ecology will need to see the program is on a clear path to making rule changes that will support cool, clean water in fishless headwater streams.

Even though Ecology is relying on the state's forest practices regulations to bring waters into compliance with the load allocations established in this TMDL on private and state forest lands, success of this TMDL project will be assessed using monitoring data from streams in the watershed.

Organizations that Implement the TMDL

Full implementation of this TMDL requires the participation of many different groups to work with landowners. The wide variety of water cleanup needs include roles for federal, state, and local governments as well as nonprofits and special interest groups. Continued funding of ongoing programs is needed as well as additional grant and special project funds to ensure BMPs are installed to address the full range of potential pollution sources. A brief description of the many implementation partners needed are discussed below.

Federal Government

U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) is jointly responsible for evaluating TMDL implementation in Washington State. EPA provides essential funding for technical assistance that allow states and tribes to implement the Clean Water Act.

Ecology encourages EPA to continue to provide Clean Water Act section 319, National Estuary Program, and other grant funds to support nonpoint pollution-reduction projects in the Padilla Bay watershed. Ecology also recommends EPA's Office of Water research section to evaluate and provide guidance and funding for better bacterial source identification methods.

U.S. Department of Agriculture

The United States Department of Agriculture (USDA) includes the Farm Service Agency (FSA) and Natural Resource Conservation Service (NRCS). The FSA provides oversight and implements several conservation programs, such as the Conservation Reserve Program (CRP) and the Conservation Reserve Enhancement Program (CREP).

CREP, an alternative of CRP, pays a yearly rental payment in exchange for farmers removing environmentally sensitive land from agricultural production and planting species that will improve environmental quality. CREP targets high-priority conservation issues identified by government and non-governmental organizations. Producers who qualify for the conservation programs will receive annual rental payments in exchange for not using the land for crop production or pasture during the life of the contract.

The NRCS is the USDA's principal agency for providing conservation technical assistance to private landowners, conservation districts, tribes, and other organizations. The NRCS provides technical assistance to land users to better address natural resource management concerns and to make sound management decisions. Programs offered through NRCS, such as the Environmental Quality Incentives Program (EQIP), provides financial and technical assistance to agricultural producers to address natural resource concerns and deliver environmental benefits.

USDA organizations are largely non-regulatory agencies - the assistance they provide is voluntary and often offers cost share to offset significant portions of the project cost. USDA staff have extensive practical experience implementing conservation programs and are often a primary contact with property owners when inquiring about conservation practices or programs. Their firsthand knowledge of watersheds and the personal relationships they've established with local landowners can be invaluable to reducing pollution in an economically feasible way.

State Government

Washington State Department of Ecology

Ecology implements several parts of the federal Clean Water Act. Ecology's authority to protect water quality is specified in state regulations under RCW 90.48. With this authority, Ecology responds to environmental complaints, conducts inspections, and issues both state waste discharge and NPDES permits. Ecology also coordinates with local watershed groups to facilitate projects that will assist the TMDL. Under our Combined Funding Program, Ecology provides financial assistance to local governments, tribes, and nonprofit groups to help fund water quality projects.

Ecology issues a number of individual and general permits in the Padilla Bay watershed including the Industrial Stormwater General Permit; the Construction Stormwater General Permit, Phase I and Phase II Municipal Stormwater General Permits, and WSDOT Municipal Stormwater Permit. Ecology will manage these permits consistent with this Water Quality Implementation Plan. Ecology will coordinate with appropriate agencies with enforcement authority, including Skagit County Planning and Development Services (code enforcement) and Skagit County Health Department (public health), and WSDA to address both point source, and nonpoint sources of pollution.

Ecology will prioritize the following actions to implement the Padilla Bay Tributaries Fecal Coliform TMDL:

- Maintain the current level of staff dedicated to nonpoint pollution complaint response and follow nonpoint guidance where water quality data point to a source of FC pollution.
- Coordinate with WSDA and local regulatory agencies on investigation and enforcement of nonpoint pollution associated with permitted dairies.

- Convene periodic meetings with responsible organizations to review water quality data for the TMDL and status of implementation activities and programs.
- Provide information about funding opportunities to local organizations.
- Assist and facilitate implementation activities leading to clean water.
- Prepare and carry out an Effectiveness Monitoring Study as resources allow to track the outcomes of implementation efforts.

Washington State Department of Agriculture

Washington State Department of Agriculture (WSDA) administers the Dairy Nutrient Management Program, RCW 90.64. WSDA has water quality enforcement responsibility for dairies and, in cooperation with Ecology, Concentrated Animal Feeding Operations (CAFOs). WSDA conducts inspections and responds to complaints at permitted licensed cow dairy facilities. Inspections are done on a regular schedule; routine inspections of all licensed cow dairies occur within an 18 to 26-month period.

Ecology does not have authority to require WSDA to take specific actions but encourages WSDA to consider the following:

- Continue to review water quality data as it relates to surface and ground waters potentially impacted by dairy activities such as (manure applications).
- Continue the excellent support and communication with Ecology and other partner's local government in discussions of ongoing and potential nonpoint, dairy and CAFO inspections/investigations.
- Require Recommend and support implementation of BMPs that are protective of water quality.
- Communicate implementation activity, funding or program opportunities, and concerns to project partners.

Washington State Department of Health

Washington State Department of Health (WDOH) Shellfish Programs monitor marine water quality in shellfish growing areas. Padilla Bay currently has one shellfish growing area that is listed as Approved (per the 2019 Annual Report)[19].

If water quality fails to meet National Shellfish Sanitation Program numeric criteria (geometric mean of 14 FC/100mL or less and an estimated 90th percentile of 43 FC/100mL or less), WDOH will restrict or close that area to shellfish harvest.

[19] https://www.doh.wa.gov/Portals/1/Documents/4400/padilla.pdf

If the growing area was Approved or Conditionally Approved before the classification is changed to Prohibited or Restricted, it is called a classification downgrade. When a shellfish growing area's classification is downgraded due to poor water quality, the county authority must create a shellfish protection district and implement a program to find and correct the pollution source(s) that are causing water quality to decline. Skagit County currently acts as a Shellfish Protection District.

Growing area restoration involves finding and correcting nonpoint fecal pollution sources that degrade marine water quality and cause closures of commercial and recreational shellfish beds. Ecology does not have authority to require specific actions of WDOH, but encourages DOH to consider the following Recommended Actions:

- Annually, the DOH Office of Environmental Health and Safety, Growing Area Section should provide a Padilla Bay status report for the annual review of monitoring and implementation progress.
- WDOH should continue to conduct a shoreline surveys of Padilla Bay as resources are available, or as need arises.
- Communicate implementation activity, funding or program opportunities, and concerns to project partners.

Washington State Department of Transportation (WSDOT)

WSDOT pollution control and prevention measures for state road and highway runoff are documented in its Municipal Stormwater NPDES Permit Stormwater Management Program Plans (SWMPPs) and includes:

- Discharge inventory and Illicit Discharge Detection and Elimination (source identification and control).
- Implementation of the Highway Runoff Manual (stormwater BMP design manual equivalent to Ecology's Stormwater Management Manual).
- Stormwater BMP retrofit program.

A WLA for WSDOT infrastructure and right of way areas within the Padilla Bay Watershed is provided in this TMDL. The following activities not currently included in WSDOT's MS4 permit can contribute to meeting that WLA and will be considered by Ecology in the next permit cycle (2024):

- If stormwater discharges that transport bacteria over natural background levels to listed receiving waters are found from sources within WSDOT's right-of-way and control, WSDOT will apply WSDOT Municipal Stormwater Permit BMPs from their SWMP or perform remediation to correct bacteria discharges. For run-on sources of bacteria identified by WSDOT that are from outside of WSDOT's right-of-way, WSDOT will notify Ecology and work cooperatively with Ecology, the local jurisdiction, and other parties involved for their resolution. (As needed)
- WSDOT will work with Ecology and Skagit County to determine potential sources of FC within WSDOT's right-of-way and control on a limited number of high priority

stormwater discharge locations to Padilla Bay. This work may include but is not limited to site visits, data review, and collaborative problem solving. (On-going)

Local Government

Skagit County

Skagit County has several departments and divisions involved in the protection and restoration of water quality. The three departments are: Public Works, Public Health, and Planning & Development Services. These departments and divisions implement programs and activities at a local level and provide oversight and data collection through programs such as the Health Departments On-site Sewage program, Public Works' Pollution Identification and Correction (PIC) program which includes the Poop Smart Initiative.

These programs, and several other local projects, work to improve water quality in the Padilla Bay and the Skagit County area. Ecology does not have authority to require Skagit County to take specific actions but encourages the county to consider:

- Continue to exercise local authority regarding existing laws, rules, and ordinances, and continue to update regulations over time to protect and prevent environmental degradation.
- Prioritize local implementation, outreach, and education related to FC bacteria issues, including health and environmental effects.
- Continue to collect and provide water quality data to inform implementation efforts, document conditions, and track changes over time.

A WLA for Skagit County's MS4 within the Padilla Bay Watershed is provided in this TMDL. The following activities not currently included in Skagit County's MS4 permit can contribute to meeting that WLA and will be considered by Ecology in the next permit cycle (2024):

- Installation and maintenance (including disposal) of pet waste stations in areas subject to the MS4 boundary areas.
- Including bacteria sampling as a part of the IDDE work described in the permit.

Skagit Conservation District

The Skagit Conservation District (SCD) Board is composed of local farmers, landowners, and concerned citizens and is dedicated to maintaining Skagit County's natural resources. The SCD's mission is to provide voluntary, incentive based options that support working landscapes while protecting and enhancing our natural resources. Its priorities and goals include:

- Farm Planning
- BMP recommendations (Technical assistance)

- Protection and improvement of surface and groundwater quality
- Watershed planning and implementation
- Riparian restoration and enhancement
- Forest stewardship
- Community wildfire prevention & protection
- Conservation education and outreach
- Natural Resource land preservation

These goals are met through SCD's extensive technical assistance, public outreach and education efforts, and ability to provide access to cost sharing programs. SCD's volunteer Board of Supervisors, guides and administers the SCD's programs to provide education and on-the-ground assistance to our cooperators. SCD staff works with private partners, local, state and federal government agencies, agricultural and natural resource organizations, and other conservation districts.

Conservation districts provide an important connection between cooperators and government agencies in order to promote and implement non-regulatory technical and financial assistance programs to conserve natural resources. SCD staff work with private partners, local, state and federal government agencies, agricultural and environmental organizations, and other conservation districts. Ecology does not have authority to require SCD to take specific actions but encourages SCD to consider:

- Continue to provide technical assistance for federal, state, and local conservation programs.
- Work with existing agency partners to further refine and target implementation efforts, based on local priorities and goals.
- Continue educational and outreach efforts, which promote conservation in all areas, and increase awareness of individual impacts and choices.
- Continue to offer landowners technical assistance and accessibility to cost-share funding programs for water quality BMP implementation.

Cities, Communities, and Special Use Districts

Local communities play a vital role in the implementation of ordinances and codes, as well as education and outreach efforts. Community efforts and initiatives are often highly effective in implementation due to local civic awareness and the ability to respond to individual concerns.

Portions of the cities of Burlington, as well as unincorporated Skagit County are located within the Padilla Bay watershed. Similarly, Drainage District 19 and the Port of Skagit are listed as secondary permittees within the TMDL boundaries. Each of these communities or District holds

NPDES Phase II MS4 permits that will help reduce and control FC bacteria discharges into local waters. The following actions by local communities are needed to implement this TMDL:

- Continue to abide by all permit requirements included in the standard MS4 permit language as well as any additional TMDL-related conditions in permit Appendix 2.
- Participate in local outreach and education programs, such as removing pet waste and proper septic maintenance.
- Continue to coordinate with county, state, and federal programs to reduce bacterial loading.

A WLA for the portion of the city of Burlington within the Padilla Bay Watershed is provided in this TMDL. The following activities not currently included in the phase II MS4 permit can contribute to meeting that WLA and will be considered by Ecology for these entities in the next permit cycle (2024):

- Installation and maintenance (including disposal) of pet waste stations in areas subject to the MS4 boundary areas.
- Including bacteria sampling and screening as a part of the IDDE work described in the permit.

Drainage District 19 and the Port of Skagit are currently subject to the Western Washington phase II municipal stormwater permit as secondary permittees. A WLA for each of these entities within the Padilla Bay Watershed is provided in this TMDL. The following activities not currently included in the phase II MS4 permit can contribute to meeting that WLA and will be considered by Ecology for these entities in the next permit cycle (2024):

- Installation and maintenance (including disposal) of pet waste stations in areas subject to the MS4 boundary areas.
- Including bacteria sampling and screening as a part of the IDDE work described in the permit.

Nonprofits, Educators, and Special Interest Groups

Local Conservation/ Salmon Recovery Groups

Skagit County is home to several salmon recovery, resource protection, and stakeholder organizations. The Skagit Watershed Council, Skagit Fisheries Enhancement Group, Skagit River Systems Cooperative, and the Skagit Land Trust are active in research, implementation, and land acquisition/protection efforts. While they are not directly working to reduce bacteria discharges, the practices they promote frequently reduce direct overland flows and discharges resulting in lower bacteria loadings.

Other temperature related BMPs may have multiple benefits that can assist in reducing bacteria loading and increasing water retention. The following actions by local conservation and salmon recovery groups are needed to support this TMDL:

- Continued engagement with federal, state, and local discussion regarding local and regional planning efforts, conservation goals, ongoing research, and stakeholder priorities.
- Continued acquisition of properties and easements to improve water quality and provide multiple benefits.

Education and Conservation Organizations

Washington State University Extension (WSU-Ex) provides non-formal education and learning activities to people throughout the country — to farmers and other residents of rural communities as well as to people living in urban areas. It emphasizes taking knowledge gained through research and education and bringing it directly to the people to create positive changes. WSU-Ex engages people, organizations and communities to advance economic well-being and quality of life by connecting them to the knowledge base of the university and by fostering inquiry, learning, and the application of research.

Ecology does not have authority to require WSU-Ex to take specific actions but encourages WSU-Ex to consider:

- Continue to partner with SCD and provide education and leadership related to the Pasture Management Program.
- Continue to provide guidance and leadership with the Livestock Advisors program.
- Continue to provide outreach, education and support related to the WSU Water Irrigation System Efficiency program.

- Continue to provide valuable community information and support with the WSU Master Gardeners program, who offer education related to sound gardening practices.
- Continue to share information related to federal, state, and local conservation programs.
- Continue educational and outreach efforts, which promote conservation in all areas, and increase awareness of individual impacts and choices.
- Work with existing agency partners to further refine and target implementation efforts, based on local priorities and goals.

Stakeholder Organizations

The support of all landowners is needed for this TMDL to be successful. The participation of stakeholder organizations and special interest groups to help guide this water cleanup process and meet TMDL project goals is vital. Their work is especially important to help government and nonprofit organizations understand and address landowner needs. Organizations such as the Western Washington Agricultural Association and Skagitonians to Preserve Farmland are active in the Padilla Bay TMDL area.

Through their work to promote and protect agricultural interests, the economic viability of the region, stewardship of the land, and local leadership efforts, these groups are an important voice of stakeholders in the region who may not be able to participate in the TMDL process directly. Ecology does not have authority to require these groups to take specific actions but encourages all to consider:

- Continued engagement with federal, state, and local discussion regarding local and regional planning efforts, conservation goals, ongoing research, and stakeholder activities.
- Advocate for financial incentives, including grants, subsidized loans, shares, leases and indirect financial assistance such as property or sales tax relief, to help landowners participate in TMDL implementation.

Priorities and Timeline

The following activities are the primary activities planned to reduce FC loading and the entities needed to work with landowners. This is not an exhaustive list, and alternative practices will be considered where appropriate. The list indicates overall TMDL priorities. Readers should refer to discussions of bacteria loading and progressive reductions earlier in this chapter to guide prioritization of local resources on a subbasin and stream-segment scale.

The implementation guidance below is intended to inform landowners of BMPs that fully protect Padilla Bay watercourses. It is not related to the permitting process or drainage maintenance mitigation agreements and is not intended to increase risk or liability associated with the district activities or its responsibilities. Significant portions of each of the four tributaries are subject to ongoing maintenance from various drainage districts and are part of a network of local drainage easements and infrastructure. All implementation efforts by individual property owners should consider existing requirements or restrictions that exist from maintenance agreements or easements within their property.

Livestock Management

Practices and partners needed to ensure all livestock rearing facilities have adequate best management practices in place are shown in Table 23. Key activities and BMPs needed include:

- Outreach and education to landowners
- Site visits to assess BMP needs
- Recommendations, design, funding assistance and supervision of Installation of site-specific BMPs
    - Exclusion fencing
    - Heavy use areas
    - Waste storage facilities
    - Gutters and downspouts
    - Pasture cross-fencing
    - Pasture maintenance activities
    - Watering facilities
    - Riparian enhancement

Table 23 - Livestock management activities and implementation partners.

	Activity	Active Partner
1	Provide education and technical assistance to industrial and non-industrial farming operations regarding livestock management BMPs.	US Department of Agriculture, Skagit County, Skagit Conservation District, Ecology, WSDA, Ecology, WSU Extension, Drainage District #19
2	Perform site visits and/or referrals to areas where problems exist.	Ecology, Department of Agriculture, WSDA, Skagit Conservation District, Skagit County
3	Provide financial incentives, including grants, subsidized loans, cost-sharing,	US EPA, NOAA, US Department of Agriculture, Skagit County, WSCC, Ecology

	Activity	Active Partner
	leases and indirect financial assistance such as property or sales tax relief.	
4	Review rules related to manure incorporation, application setbacks, and seasonal application timing.	Department of Agriculture, Ecology, Skagit Conservation District, Federal agencies
5	Continue to develop Farm Plans and other planning documents.	Department of Agriculture, Skagit Conservation District, Federal agencies, Ecology
6	Continue education and outreach efforts related to the proper storage of manure through the "Poop Smart" campaign.	Skagit Health Department, Skagit Public Works, Skagit Conservation District, Ecology
7	Provide education program related to reduced tillage practice and potential water quality benefits.	Skagit Conservation District, Department of Agriculture, WSU Extension, USDA, NRCS, Ecology
8	Continue to collect water quality data to determine trends.	Skagit Public Works, Ecology, Skagit Conservation District

Stormwater Control

A significant volume of bacterial loading comes from untreated stormwater. BMPs targeted at slowing, capturing, or filtering stormwater are important in reducing bacterial loading to tributaries that feed into Padilla Bay. Activities and partners needed to manage stormwater in this TMDL are listed in Table 24.

Table 24 - Stormwater control priorities

	Activity	Active Partner
1	Promote low impact development (LID) and water retention offsets for new development and redevelopment.	Skagit County Development Services, Skagit County Public Works, Skagit Conservation District, Ecology
2	Install or retrofit water quality structural controls on public and private lands with LID facilities.	Skagit Development Services, Skagit Public Works, Skagit Conservation District, Ecology
3	Inspect feedlot operations to evaluate feedlot runoff.	Department of Agriculture, Ecology
4	Perform IDDE in MS4 discharging to the Padilla Bay watershed. Include FC and E. coli sampling during screening.	City of Burlington, Skagit County, Drainage District #19, Port of Skagit
5	Educate the public on proper pet waste management.	Local municipal stormwater permittees
6	Institute a street sweeping program within MS4 serving Padilla Bay TMDL area.	City of Burlington, Skagit County
7	Continue to collect water quality data to detect issues and reduce loading.	Skagit Public Works, Ecology, Skagit Conservation District, Department of Agriculture
8	Install pet waste bag dispensers in all public parks and areas in the Padilla Bay TMDL area.	Skagit Public Works, Skagit County Health Department, Skagit Conservation District, Ecology
9	Maintain education posting in public areas, expand in other public areas.	Skagit Public Works, Skagit County Health Department, Skagit Conservation District, Ecology
10	Continue education and outreach efforts related to the proper disposal of pet waste through the "Poop Smart" campaign.	Skagit Public Works, Skagit County Health Department, Skagit Conservation District, Department of Agriculture, Ecology

Onsite septic systems

Per the Skagit County Health Department website: "Septic systems treat sewage on the property where it is generated. Over 18,000 septic systems in Skagit County clean and recycle sewage contaminated water into clean groundwater every day in Skagit County. On-site sewage treatment can work as well or better than large wastewater treatment plants with proper design, installation, and maintenance." Key efforts and implementation partners are included in Table 25.

Table 25 - Onsite Septic System (OSS) maintenance activities and partners

	Activity	Active Partner
1	Provide outreach and education regarding bacterial contamination and OSS programs.	Skagit County Health Department, Washington Department of Health
2	Continue education and outreach efforts related to the proper maintenance of OSS through the PIC program.	Skagit Public Works, Skagit County Health Department Skagit Conservation District, Department of Agriculture, Ecology
3	Provide financial incentives and assistance for repair/replacement of failing OSSs or hook-up to sanitary sewers.	Skagit Health District working with Craft 3

Human waste sources due to a lack of restroom facilities

The lack of toilet facilities may cause direct loading by recreational or homeless use. The construction of temporary or permanent restrooms and educational outreach can assist in reducing nonpoint bacterial loading, as well as additional information found in Table 26.

Table 26 - Human waste source reduction activities

	Activity	Active Partner
1	Evaluation and placement of temporary or permanent facilities in recreational/hunting high use areas.	Skagit County Health Department, Skagit Public Works
2	Evaluation and placement of temporary or permanent facilities in area with homeless populations.	Skagit County Health Department, Skagit Public Works, City of Burlington, Community of Bay View
3	Continue education and outreach efforts related to the proper disposal of waste while recreating through the "Poop Smart" campaign.	Skagit Public Works, Skagit County Health Department, Skagit Conservation District, Department of Agriculture, Ecology

Implementation Costs and Funding Sources

The cost of BMPs needed to control bacteria loadings to the Padilla Bay watershed was developed by Ecology TMDL and nonpoint field staff through GIS analysis, review of aerial photography, and historical knowledge of the watershed. While this TMDL uses site inspection and field data, the proposed number of implementation actions and the related budget are largely based on the estimated need for BMPs where the presence of potential pollution sources was likely to occur. Actual BMP needs were not fully verified by field observations. This costs detailed below focus on likely additional structural BMPs and do not reflect associated staffing costs or current resources currently addressing a portion of the estimated implementation needs unless specified otherwise.

This exercise of potential BMP site identification is intended to start discussion with conservation partners within a target implementation area as well as guide funding agencies in their planning and decision-making. Some of the BMPs identified in this plan may, under closer inspection, turn out to not be needed at the time of a site visit, even though land use patterns could support a particular pollution-generating activity. Similarly, future field evaluations may find problem sites that this plan failed to include in its estimation of BMP needs and costs. Conservation partners are encouraged to employ adaptive management, remove sites, add sites to the list, and change site rankings as new information is available.

We developed the following list of twelve practices to identify and characterize the BMP needs by stream reach. The list provides conservation partners with general guidance on likely workloads and cost estimates and should be used for planning purposes only.

LEF - Livestock exclusion fencing

HUP – Heavy use protection

WF – Watering facility

MM – Manure management

SWC – Stormwater control

VB – Vegetated buffer

OSS – Onsite septic

MS4 – MS4 inspections/concerns

PWD – Pet waste disposal

SI – Site inspection

PSI – Partner Site inspection

History - Past documented issues

We developed a ranking system to prioritize sites (or reaches) for implementation based on our understanding of the highest potential for bacterial loading. Once Ecology staff and conservation partners begin working on a site, they may find that additional or alternate practices may be necessary or adequate to address pollution sources. For example, livestock exclusion fencing (LEF) is a key practice recommended within the Padilla Bay watershed. However, fencing is not the only way to ensure livestock are kept out of streams. The development of site specific practices may provide cheaper, yet successful alternatives. When these adaptations are made, steps should be taken to ensure that the chosen alternate management methods are sufficient to achieve water quality standards in the long term. Assurance can be achieved in part through site follow-ups to confirm that the alternative BMP is functioning and that necessary site maintenance activities are occurring.

Estimated costs by category

The costs of installing and carrying out the activities needed to reduce bacteria levels in the Padilla Bay watershed are provided by category below based on aerial imagery analysis. This did not include field verification, and it should be noted that site-specific conditions will determine actual project costs and may vary significantly from the figures used below. We estimated BMP costs by consulting the NRCS BMP guidelines, NRCS site scenarios, USDA cost share limits, and estimates from local conservation district and regional conservation partner staff. We also collected data pertaining to the installation and cost of the listed practices internally from Ecology TMDL implementation specialists. Cost estimates below do not include staff time for related outreach work and overhead.

Livestock exclusion fencing

Estimated fencing needs are based on an aerial image review, with distances estimated using satellite imagery software measurement tools. Fencing should be designed using the NRCS guidelines found in the field office technical guide (FOTG). Specific fencing types and styles are recommended based on the observed or anticipated type of livestock and site conditions. The cost of the fencing will depend on style and materials used. Information collected by the USDA Extension service guidance[20], costs (including labor and materials) range between $5- 7 per foot for woven wire, barbed wire, and electric fencing. To account for the increased cost of materials and labor since 2012, as well as Ecology implementation specialist input, $7-10 per foot was used as the typical cost for fencing projects across the state. Specific projects may require additional elements (high tensile materials, additional height fencing) which may exceed the $10 per foot budget estimate.

Based on GIS review, an estimated 47,850 linear feet may be necessary in the Padilla Bay watershed. Exclusion fencing adjacent to waterways and storm drainage systems should be used in conjunction with buffers/filter strips. In many cases the existing ground cover appeared to be adequate, however fencing should be installed with adequate setbacks to the water course to ensure water quality protection.

The estimated cost of installing LEF is between **$334,950** to **$478,500.** The cost of cross fencing to promote rotational grazing and pasture management are not included in this estimate.

Heavy Use Protection

Heavy Use Protection (HUP) is used to stabilize a ground surface that is frequently and intensively used by people, animals, or vehicles. While not specifically used to reduce bacteria loading, the installation of HUP areas reduces onsite erosion and therefore limits bacterial transport. In order to reduce the negative water quality impact of heavy use areas, landowners should locate them as far away as possible from waterbodies or water courses.

[20] https://www.extension.iastate.edu/agdm/livestock/pdf/b1-75.pdf

In some cases, this may require relocating the heavily used area rather than armoring an area that is already in use. Preferred practices would limit impervious surfaces, such as concrete pads, used for protections. Gravels and stabilizing materials (such as geotextile fabric) are the preferred option when feasible, based on NRCS HUP guidance.[21]

Based on NRCS FOTG guides and scenarios for HUP practices (NRCS practice code 561), average practices range between 2,500-4,000 square feet, but actual size should be developed based on the number of animal units and other site specific information. HUP scenarios used to estimate typical costs place each practice cost between $10,000 and $16,000. Aerial imagery identified 36 potential locations, for a total expected cost of between **$360,000** and **$576,000**.

Manure Management

Manure Management (MM) is a broad description of several categories described in the Manure Management section (page 65), ranging from onsite manure storage, to timing and application rates based on individual farm conservation plans. Properly designed manure storage facilities are part of MM and are useful in reducing bacterial loading.

Several programs are available to address manure and nutrient issues within the Padilla Bay watershed, such as the Dairy Nutrient Management Program, farm planning resources available through the Skagit Conservation District, as well as the Manure Exchange Program operated by Skagit County. The costs to operate and maintain these existing programs are not included in this budget.

A review of aerial imagery identified 126 sites as potential locations in need of practices related to manure management. The identification of these sites was based on the apparent presence of livestock, or livestock access to the area. Sites with evidence of livestock were documented and Ecology staff provided recommendations based on conditions observed in the imagery. Site specific issues or concerns were not identified due to limited imagery and the current inability to gather field data due to Covid-related restrictions.

In order to properly estimate costs, we need to know more about the site criteria and conditions. Manure collection and storage needs are influenced by species, manure handling, grazing, confinement, etc. For example, a structure consisting of a simple 3 bin structure with 8'x 8' bins could cost as much as $10,000. This would store the waste for a two horses for 6 months in a typical scenario. Adding a roof to the storage structure could add an additional $6,000 - $10,000.

Based on NRCS design criteria and site scenarios, we will assume a cost between $10,000 and $15,000 per structure. In addition to this, we are making a conservative assumption that 15 percent of the sites with possible livestock rearing activities are in need of a new or redesigned storage facility. A total expected cost estimate for manure management ranges between **$189,000** and **$283,500**.

[21] https://efotg.sc.egov.usda.gov/references/public/MO/561HeavyUseAreaProtection.pdf

Other costs to consider include the creation of additional lagoons, expansion or upgrades to existing lagoons (if feasible), and costs associated with the de-commissioning of old lagoons. Dairy lagoons must meet specifications as defined by NRCS. Based on conversations with experienced field staff, five lagoons were identified as potentially needing expansions or capacity upgrades. Estimated costs to replace lagoons are highly variable based on capacity, site conditions, engineering, and constructions costs.

A recent Skagit County lagoon project with a steel tank was estimated at $950,000 for 2.6 million gallons. This does not include permitting, soil sampling or preloading costs, nor pump or piping to make effective. Costs vary significantly depending on earthen or steel tank or concrete tank, soil loading capacity, preload requirements, availability of clay lining material for earthen structures, availability of contractors, etc. The cost to replace five manure lagoons could exceed **$5,000,000.**

Stormwater control

Stormwater Control (SWC) covers many land uses and may involve MM as noted above or IDDE in the case of MS4s. In this analysis it refers to control of all stormwater not managed in a regulated storm sewer system. Controlling runoff is essential in improving water quality in the Padilla Bay Tributaries TMDL project area. Stormwater is the combined rain and snow melt that runs off of rooftops, paved streets, highways, and parking lots and into storm drains or nearby surface waters. As the water travels along these impervious surfaces, it picks up pollution like oil, fertilizers, pesticides, soil, trash, and animal manure. Most stormwater is not treated, even when it goes into a street drain or drainage system. Instead, it deposits the pollution it carries directly into streams, lakes, and marine waters.

Gutters, downspouts ($7 – 9 per linear foot) and outlet piping ($20 per linear foot) may be necessary to upgrade existing livestock facilities. The additional plumbing would direct water away from potential sources of pollution during rain events. Cost sharing for gutters, downspouts, and outlet piping, may be available through federal, state, or local cost share programs. NRCS offers guidance under practice 651 in the FOTG. A conservative estimate of 20 percent of sites identified would benefit from additional gutters and downspouts.

Similarly, installing roofing structures on existing storage structures is an excellent way to prevent additional bacteria contamination. However, based on the variability of the structures (size and length of downspouts and gutters, need for a roof) and other necessary equipment to protect water quality, additional information should be collected based on site visits and priority locations.

Watering Facilities

Watering Facilities (WF) are designed to provide alternative locations for livestock to get water while protecting streams from livestock damage and fecal contamination. This BMP is recommended on sites where it appears that animals have direct access to the watercourse as a primary drinking source. It can also be used near other vulnerable surface waters where water quality is an issue.

Due to animals congregating near the WF, this practice often includes HUP near the watering location. The resulting HUP costs are considered in the HUP section above, and not duplicated here.

The assessment identified 32 sites for potentially installing a watering facility. Based on NRCS site scenarios and cost share program guidelines, the estimated cost is approximately $2,500 to $4,000 per facility, for a total of **$80,000** to **$128,000**.

Vegetated buffers/filter strips

Buffer width is variable depending on the type and goal of the implementation project, ranging from simple filter strips to full forested buffers. The recommended forested buffer width is variable across each tributary, ranging from 35' to 100', depending on where you are located within the tributary. Due to this variety of practices, prices range from $500 -$2,000 per acre. This cost includes site preparation, plant materials, plant protectors, and planting labor.

We estimated the amount additional buffer acreage needed by measuring total length of each stream reach using ArcGIS aerial imagery and applying a width of 35 feet (recommended filter strip width). It must be noted that this is a very coarse estimate. Site visits were not conducted to verify the presence or absence of buffers, and in some cases, it was difficult to determine where the ditch in-slope ended, and where a buffer or filter strip began.

Estimated buffer width within the TMDL areas is 354 acres (assuming 35-foot width). This is based on identified properties adjacent to the water courses that do not have buffers. Total costs range from **$177,000** to **$708,000**. This budget is based on filter strips to address bacteria which is the focus of this TMDL, and Ecology understands this practice may not address other functions to protect water quality. Property owners can choose to plant larger filter strips where necessary, or may also plant hedgerows or forested buffers.

Onsite Septic Systems

Onsite septic systems (OSS) system maintenance, upgrades, or replacements are another set of key practices to reduce potential bacterial loading within the Padilla Bay watershed. Skagit County has a robust, proactive septic inspection and education program through the Skagit County Health Department. The County systematically contacts landowners and ensures inspections of OSS on a one to three-year cycle, depending on the type of system. The ongoing cost to maintain this program is not accounted for within the budget estimate. Skagit County and nonprofit lender Craft 3 are working together to offer homeowners affordable septic system financing with the Clean Water Loan. This program seeks to minimize the economic impact of replacing a septic system when repair/replacement costs average between $10,000 and $20,000 per unit.

Pet Waste Disposal

Pet waste disposal (PWD) is identified as a BMP that may be increased or expanded within the Padilla Bay Tributaries TMDL area to reduce fecal coliform pollution. Skagit County, as well as local communities such as Bay View, already have existing PWD stations and support.

Additional stations may be beneficial in existing public spaces, as well as areas that may be developed in the future. Installation of new stations can cost between $250 – 500 dollars per station, with anticipated additional costs for supplies and site maintenance. Skagit County, as well as local communities such as Bay View, already have existing PWD stations and support. Additional stations may be beneficial in the communities, as well as areas that may be developed in the future. A general estimate of 30 stations at a total cost of **$7,500** to **$15,000** may support bacterial reductions.

Site Identification
Site inspections (SI) or site visits are important tools to identify, document, and reduce nonpoint source pollution. In general, Ecology staff identify sites with nonpoint sources of pollution in one of two ways:

1. Observing sites from public access points during watershed evaluations, or
2. Responding to complaints/referrals.

The basic difference in these two approaches is whether staff are proactively surveying impaired watersheds to identify nonpoint sources of pollution, or are reacting to information provided by complainants or other partners. Ecology staff will continue to support site identification efforts through existing budgeted sources and positions.

Partner Site Inspections
Partner site inspections (PSI) refer to additional site inspections related to programs operated by the various local, state, or federal entities operating in the Padilla Bay watershed. Programs run under partners are key to identifying, documenting, and reducing nonpoint source pollution. These programs operate under existing budget sources under the various entity conducting the inspections. No additional funding is included in the estimate.

Outreach and Education
Outreach and education programs to create community awareness of local pollution issues and motivate citizens to adopt BMPs should be tailored to the specific needs of that community. Although uniform, targeted message delivery from each implementing partner is ideal, it is not always possible. Skagit County's Poop Smart Campaign does a great job of meeting that expectation and should be continued in the Padilla Bay watershed. Because of the wide coverage area, changing annual needs, the specific costs to continue the Poop Smart Campaign were not estimated in this report. The ongoing outreach and education efforts of the Skagit Conservation District are similarly a critical resource that is needed to implement this TMDL; however, multiple staff at the District play important but different outreach roles and the staff requirements could not be estimated for this report.

Based on the estimated costs for each type of BMP, Table 27 shows a summary of the total estimated costs.

Table 27 - Potential BMP costs based on initial remote assessment

Practices/Programs	Estimated cost (Low)	Estimated cost (High)
LEF - Livestock exclusion fencing	$334,950	$478,500
HUP – Heavy Use protection	$360,000	$708,000
MM – Manure management	$189,000*	$283,500*
SWC – Stormwater control	As existing programs allow	As existing programs allow
WF – Watering facility	$80,000	$128,000
VB – Vegetated buffer	$177,000	$531,000
OSS – Onsite septic	As existing programs allow	As existing programs allow
MS4 – MS4 inspections/concerns	As existing programs allow	As existing programs allow
PWD – Pet Waste disposal	$7,500	$15,000
SI – Site inspection	As existing programs allow	As existing programs allow
PSI – Partner Site inspection	As existing programs allow	As existing programs allow
Total potential costs	**$959,450**	**$1,905,500**

*Including Manure lagoon upgrade or replacement may add an additional $5,000,000 to estimated cost

Funding to address water quality impairments

The costs of improving water quality are highly dependent on the local priority, target areas, and specific BMPs selected to address issues. For example, if septic system inspection, maintenance, and replacement is selected as a local priority, the cost of each replacement is significant when including local staff training, inspection/record keeping, and property owner expense. While the BMPs are costly, their careful selection and replacement can yield significant bacterial reduction and prevent the spread of other human pathogens. The prevention of diseases these pathogens cause can translate into lower health care costs.

In an effort to offset the costs to individuals, a number of local, state, and federal programs are available. A list of potential funding sources can be found on the Ecology website for water quality grants and loans.[22] Various conservation partners offer other opportunities for funding the recommended BMPs. Examples of grant opportunities from the Ecology website include:

Clean Water Act Section 319 federal grants
The U.S. Environmental Protection Agency (EPA) provides grants to Washington under Section 319 of the federal Clean Water Act (CWA). The state is required to provide a 40 percent match in funding.

[22] https://ecology.wa.gov/About-us/How-we-operate/Grants-loans/Find-a-grant-or-loan/Water-Quality-grants-and-loans

The Section 319 grant program offers funding to eligible nonpoint source pollution control projects, similar to the state Centennial Clean Water Program. Each year, EPA awards Section 319(h) funds to states in accordance with a state-by-state allocation formula that EPA has developed in consultation with the states.

Centennial Clean Water Program grants
To improve and protect water quality, the state Centennial Clean Water Program provides grants for water quality infrastructure and nonpoint source pollution projects. Eligible infrastructure projects are limited to wastewater treatment construction projects for financially distressed communities. Eligible nonpoint projects include stream restoration and buffers, on-site septic repair and replacement, education and outreach, and other eligible nonpoint activities.

Clean Water State Revolving Fund loans
Provided by the federal CWA, the Clean Water State Revolving Fund (CWSRF) program is funded through an annual EPA capitalization grant, state matching funds, and principal and interest repayments on past program loans. The CWSRF program provides low-interest and forgivable principal loan funding for wastewater treatment construction projects, eligible nonpoint source pollution control projects, and eligible "green" projects.

Stormwater Financial Assistance Program grants
The Stormwater Financial Assistance Program (SFAP) is designed to fund stormwater projects and activities that have proven effective at reducing impacts from existing infrastructure and development and enhance existing stormwater programs. Stormwater facility projects and a limited set of stormwater activities project types are eligible for SFAP funding.

Ecology has also established nonpoint targeted funding opportunities with limited funds (less than $50,000) under the Direct Implementation Funds (DIF) and the Coastal Protection (Terry Husseman) grants. DIF funds are typically sponsored by Ecology staff, and are targeted at a specific goal. Coastal Protection grants are typically flexible in targeting efforts, but do not include any administration or indirect costs, and are used for project labor and materials only.

In addition to Ecology's funding or pass-through programs, there are other funding sources available for TMDL implementation and other water quality efforts. Depending on the type of grant, this may include watershed planning, pollution identification and tracking, water quality monitoring, point and nonpoint source pollution management, fish and wildlife habitat enhancement, stream restoration, and water quality education. Public sources of funding include federal and state government programs, which can offer financial as well as technical assistance.

United State Department of Agriculture (USDA)
The USDA offers several programs and funding sources to agricultural property owners and producers. The majority of agricultural producers have established relationships with Farm Service Agency (FSA) or Natural Resource Conservation Service (NRCS) staff from participating in programs such as crop certifications or BMPs technical assistance/installation projects.

The various funding programs described below have specific requirements and site characteristics to determine eligibility.

USDA Conservation Reserve Program (CRP)
The CRP is a voluntary conservation program for agricultural landowners and producers. By enrolling property in CRP, landowners can receive annual rental payments and cost-share assistance to establish long-term, resource conserving vegetative or vegetation covers on eligible farmland. The program payments are based on soil type, slope, or areas of highest conservation concern. The duration of the contact is typically between 10-15 years, with the potential option to re-enroll the property after the contract expires. There are designated sign-up periods for CRP.

USDA Continuous Conservation Reserve Program (CCRP)
Similar to CRP, the CCRP program cost-share to producers to implement riparian buffers on agricultural land. One significant difference from CRP is that properties are only eligible for CCRP if the adjacent watercourse has documented presence or usage from Endangered Species Act (ESA) threatened Salmon and Steelhead. Cost share rates on CCRP projects are 90 percent of the cost of establishment, and the payment rates tend to be less that CRP rates. While temperature is not the focus of this TMDL implementation effort, establishing buffers can help prevent and/or filter runoff. Not all waters within the Padilla Bay watershed may qualify for this program.

USDA Conservation Reserve Enhancement Program (CREP)
The Washington Conservation Reserve Enhancement Program (CREP) targets Salmon bearing waters, with a goal of establishing permanent resource conserving native plant species and removing environmentally sensitive lands from resource production. Eligible participants will receive 100 percent of the cost to establish the required buffer, as well as an annual rental rate for the duration of the contract. In addition, the program provides oversight and maintenance for about five years after planting to assure success, as well as a monetary bonus for signing up. Not all waters within the Padilla Bay watershed may qualify for this program.

USDA Environmental Quality Incentives Program (EQIP)
The federally funded Environmental Quality Incentives Program (EQIP) is administered by NRCS. EQIP is the combination of several conservation programs that address soil, water, and related natural resource concerns. EQIP encourages environmental enhancements on land in an environmentally beneficial and cost-effective manner. The EQIP program provides technical assistance, cost share, and incentives based on individual program need and eligibility.

USDA Agricultural Conservation Easement Program (ACEP)
ACEP is a federal funding program administered by NRCS that consists of two components: Agricultural Land Easements and Wetland Reserve Easements. Under the Agricultural Land Easements component, NRCS helps Indian tribes, state and local governments and non-governmental organizations protect working agricultural lands. Under the Wetlands Reserve Easements component, NRCS helps to restore, protect and enhance enrolled wetlands.

Land protected by agricultural land easements provides additional public benefits, including environmental quality, historic preservation, wildlife habitat and protection of open space. The length of the individual easement is designed to be flexible, with generally increasing payment rates based on the length of easement or type of project.

Additional programs or cost share options may be available in the Padilla Bay watershed. You can contact the local USDA service center for more information.

Other grant or funding opportunities include:

Salmon Recovery Funds
In 1999, the Washington State Legislature established the Salmon Recovery Funding Board. Since 1999, the board has awarded more than $477 million in grants to more than 1,700 projects in 31 of the state's 39 counties. Salmon Recovery Boards identify projects annually for funding. Many salmon recovery projects benefit water quality, and may reduce bacterial loading as a secondary benefit.

RCO Farmland Preservation Grants
The Washington State Recreation and Conservation Office manages a Farmland Preservation Grant program that provides funding to cities, counties, nonprofit organizations and the state Conservation Commission to buy development rights on farmlands to ensure lands remain available for farming in the future. Through the Farmland Preservation program, grant recipients can also help to restore ecological functions. The primary purpose of this grant program is to conserve farmland, but up to 50 percent of total acquisition costs may be devoted to restoration activities per grant, so significant TMDL implementation could be accomplished through this source.

Washington State Conservation Commission
The Washington State Conservation Commission (SCC) is the coordinating state agency for all 45 conservation districts (CDs) in Washington State. Together, the SCC and CDs provide voluntary, incentive-based programs that empower private landowners to implement conservation on their property. Programs such as Shellfish Program, Natural Resource Investments, Voluntary Stewardship Program (VSP) and Conservation Reserve Enhancement Program (CREP) are delivered at the local level by conservation districts. These programs connect people with helpful expertise and financial support for constructing projects and adjusting land management practices to best care for Washington's resources.

Nonprofit organizations may also be sources of implementation dollars. The goals and targets of the organization will determine eligibility of the applicants. Fisheries or wildlife enhancement groups are often looking to acquire property, or may offer easements in selected areas. Forming partnerships with other government agencies, nonprofit organizations, and private businesses can often be the most effective approach to maximize funding opportunities.

Outreach

Stakeholder engagement and public support is essential for the required implementation efforts necessary to achieve water quality standards. Ecology staff will work closely with partners to assist in the development of a well thought out and executed public outreach strategy.

Ecology staff will likely not be playing a lead role in public outreach efforts outside of the TMDL document development and technical review process. Instead, local partners will likely take a lead role in outreach and implementation of the specific programs that they oversee (e.g., County Health Departments - septic system repairs). Implementation staff should focus their outreach efforts in communicating water quality cleanup priorities with their counterparts in other agencies and developing relationships.

Ecology staff will work with the partners in the watershed to provide landowners pertinent information on water quality issues, appropriate BMPs, and sources of funding. The outreach will include landowner mailings, workshops, personal site visits, and other unique ways to get information to the people who need it. Outreach efforts will also include a review of past and current efforts to evaluate effectiveness and public response.

Portions of the TMDL were made available to the technical advisory team members to review and provide edits. Representatives from organizations outlined as having a role in implementing this TMDL were invited to participate in guiding and selecting implementation targets and priorities.

A 30-day public comment period was held on this TMDL and implementation plan from 10/22/2020 to 11/22/2020. Two virtual public meetings were held on 10/28/2020 to provide information to the public, and provide an opportunity to address questions. Twelve sets of comments were received including letters, emails, and ecomment submissions. Ecology's response to these comments and any resulting changes in the TMDL are described in Appendix B.

Tracking Progress

Implementation/Milestone Tracking

Entities with regulatory authority will be responsible for following up on any enforcement actions. Individual and general permittees will be responsible for meeting all the requirements of their permits, and permit language may be reviewed if site specific concerns are found.

Those conducting restoration projects or installing BMPs will include clear language regarding responsibility for maintenance of improvements, structures, or other implementation activities. Ecology's TMDL coordinator will work with conservation organizations, stakeholders, and other partners to track implementation activities occurring in the watershed. Tracked activities should include BMPs or projects in the watershed that reduce bacterial loading as a primary or

secondary benefit. Implementation tracking efforts should be a quantitative as possible, including details such as:

- Accurate location and size description of the project, including GIS based information, if available (i.e., total feet of fencing installed, septic systems replaced, runoff reduction BMPs installed).
- Type of BMPs installed, project cost, and potential reductions based on BMP effectiveness estimates.
- Map and share areas of active grants or program areas with conservation partners and identity project targets in highest priority areas.
- Identify and track potential problem areas and barriers to implementation (i.e., locations where outreach or technical assistance was not accepted when offered).
- Document education and outreach efforts – include maps of targeted mailings, track survey participation/interest of landowners.

In many cases, there are specific elements of Conservation District activities are protected from public disclosure due to privacy concerns. Information will only include the available project and monitoring data that is not protected by privacy rules and regulations.

Implementation progress will be evaluated based on the goals of the implementation schedule, BMP installations, education and outreach efforts, and water quality data. The primary goal will be to assess how efficiently projects are being implemented and how effective they are in improving water quality conditions.

No centralized implementation-tracking tool currently exists within the Water Quality program. Depending on Ecology's resources and current implementation tracking tools, the coordinator will use a spreadsheet/database, Ecology's TMDL management database, and/or geographic information system (GIS) mapping to track where implementation has occurred or is planned. Each organization should track the implementation progress they have made, and make an effort to share appropriate project information (or potential barriers) with conservation organizations and stakeholders to determine if alternative approaches/programs would be successful, or prevent duplication of efforts.

Adaptive Management

Natural systems are complex and dynamic. The way a system will respond to human management activities is often unknown and can only be described as probabilities or possibilities. Adaptive management involves testing, monitoring, evaluating applied strategies, and incorporating new knowledge into management approaches that are based on scientific findings. In the case of TMDLs, Ecology uses adaptive management to assess whether the actions identified as necessary to solve the identified pollution problems are the correct ones and whether they are working. As we implement these actions, the system will respond, and it will also change. Adaptive management allows us to fine-tune our actions to make them more

effective, and to try new strategies if we have evidence that a new approach could help us achieve compliance.

Partners will work together to monitor progress towards these goals, evaluate successes, obstacles, and changing needs, and make adjustments to the implementation strategy as needed. Ecology will use adaptive management when water monitoring data show that the TMDL targets are not being met or implementation activities are not producing the desired result. If water quality standards are achieved, but WLA and LAs are not, the TMDL will be considered satisfied.

A feedback loop (Figure 27) consisting of the following steps will be implemented.

Step 1. The activities in the water quality implementation plan are put into practice.

Step 2. Programs and BMPs are evaluated for technical adequacy of design and installation.

Step 3. The effectiveness of the activities is evaluated by assessing new monitoring data and comparing it to the data used to set the TMDL targets.

Step 3a. If the goals and objectives are achieved, the implementation efforts are adequate as designed, installed, and maintained. Project success and accomplishments should be publicized and reported to continue project implementation and increase public support.

Step 3b. If not, then BMPs and the implementation plan will be modified or new actions identified. The new or modified activities are then applied as in Step 1.

Additional monitoring may be necessary to determine bacteria sources and target BMPs, which are designed and implemented to address all sources of bacteria to the streams. It is ultimately Ecology's responsibility to assure that implementation is being actively pursued and water standards are achieved.

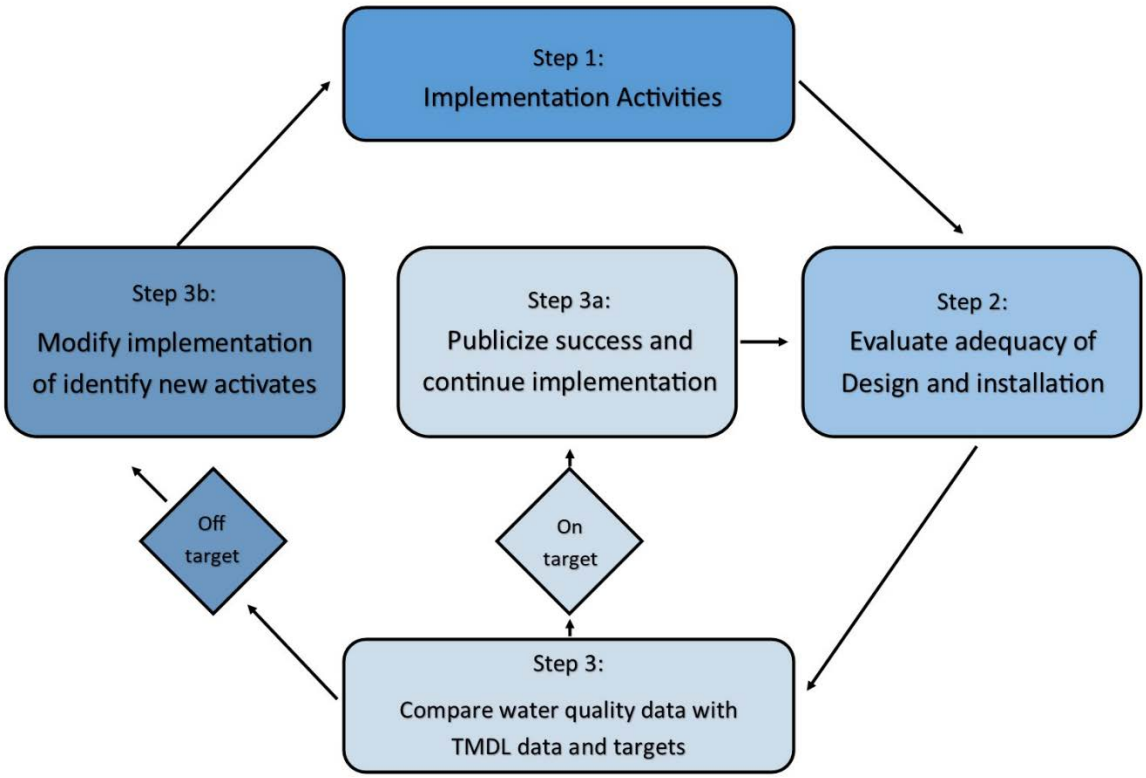


Figure 27 - Feedback loop for determining need for adaptive management. Dates are estimates and may change based on resources and implementation status.

Monitoring Plan

A monitoring plan will be used to determine if the interim targets and water quality standards have been met after the measures described in the water quality implementation plan are functioning (i.e., the in-stream water quality monitoring). The Environmental Assessment (EAP) program within Ecology usually conducts the effectiveness monitoring of TMDLs. Additional monitoring efforts may already be established in relation to public health, local priority, or other state/federal agency programs. Efforts to coordinate with other monitoring efforts should be a priority to compare monitoring results and reduce the duplication of efforts.

A Quality Assurance Project Plan (QAPP) should be prepared before any water quality monitoring is conducted by Ecology or others. The QAPP should follow Ecology guidelines (Lombard and Kirchmer, 2004), paying particular attention to consistency in sampling and analytical methods. This will help ensure that all monitoring efforts are completed according to state and/or federal protocols and results may be used for regional analysis efforts. The Ecology TMDL coordinator can assist in providing recommendations regarding monitoring schedules and locations based on this report and completed implementation efforts.

This plan includes monitoring that will be done by other entities if there is any planned. The EAP technical lead makes general recommendations, and negotiates and reviews content with TMDL coordinator for final draft. The QAPP will set minimal monitoring to be done and targets

to see if the implementation is meeting goals. The TMDL coordinator will monitor the implementation actions and how they are maintained.

Effectiveness monitoring should include sampling for *E. coli* bacteria, in addition to FC bacteria. In 2019, Ecology's rulemaking updated bacterial indicators and numeric criteria to protect water contact recreational uses. Moving forward, *E. coli* will be the bacterial indicator in freshwater, and therefore should be sampled within effectiveness monitoring. By collecting FC bacteria samples alongside *E. coli* samples, a relationship between FC and *E. coli* concentrations in the watershed may be established. The FC samples will help to show any improvements to past concentrations, and *E. coli* will be used to assess compliance with new water quality standards.

Effectiveness monitoring will be performed to determine the effectiveness of this implementation plan. Effectiveness monitoring will compare the results from BMP implementation and other restoration activities against compliance with water quality standards. Effectiveness monitoring in the Padilla Bay watershed will be conducted in a way to allow for comparisons with the initial 303(d) listings. If the results from the effectiveness monitoring show that water quality standards are now being met, this information should be provided to Ecology through the Water Quality Assessment process.

Any monitoring should consider the critical periods for the stream reach as described in the TMDL document. Per the TMDL goals, monitoring should focus on assessing bacterial concentrations in the watershed. Additional parameters may be included based on regional priorities, such as reducing stream temperatures and nutrient loading. The parameters that may be included (as funding allows) in effectiveness monitoring include:

- Continuous DO
- Continuous pH
- Continuous temperature
- Total nitrogen
- Nitrate-nitrite nitrogen
- Ammonia nitrogen
- Total Phosphorus
- Ortho Phosphorus

While these parameters are not directly related to FC bacteria, this will support other TMDL and water quality assessment and improvement work that is ongoing in the watershed.

Reasonable Assurance

Ecology believes that the activities identified in this chapter already support this TMDL and add to the assurance that bacterial loadings in the Padilla Bay watershed will meet criteria in the Washington State water quality standards. This assumes that the identified activities are continued and maintained.

Ecology has a working relationship with the Skagit Conservation District and other implementation partners that ensures appropriate information is shared and the BMPs detailed

in this plan are implemented. Ecology staff will, when allowed access, inspect properties for the presence of appropriate BMPs and provide landowners information on the BMPs identified in this plan when necessary.

In areas with observed, reported, or documented bacterial pollution issues, Ecology may refer the property owner to a local conservation organization to evaluate the problem and work to find a solution. Despite the best efforts of Ecology and partners in the watershed, some landowners may be unwilling or unable to perform the steps needed to protect water quality at their property. It then becomes Ecology's responsibility to evaluate whether their activities are "causing, or have the potential to cause" pollution in violation of the state's Water Pollution Control Act (RCW 90.48). In these situations, where appropriate, Ecology will pursue enforcement as needed to gain compliance.

Where remedial action is necessary, Ecology will inform landowners of the specific management problems and required actions in detail within 60 days of the initial site inspection. The notification will be in the form of a technical assistance letter. The letter will detail the inspector's findings and suggested improvements. With the exception of serious ongoing violations, landowners will be given an opportunity to proactively seek technical and financial assistance from Ecology and its partners. Ecology staff will work with the partners and landowners to design and implement the projects and ensure BMPs are implemented in ways that are adequate to protect surface water.

Ecology is authorized under Chapter 90.48 RCW to impose strict requirements or issue enforcement actions to achieve compliance with state water quality standards. However, it is the goal of all participants in the TMDL process to achieve clean water through cooperative efforts. Education, outreach, technical and financial assistance, permit administration, and enforcement will all be used to ensure that the goals of this TMDL are met.

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Appendix A: Background

Any necessary details to support Chapter 1 can be included in Appendix A.

Clean Water Act and TMDLs

What is a Total Maximum Daily Load (TMDL)?
A TMDL is a numerical value representing the highest pollutant load a surface water body can receive and still meet water quality standards. Any amount of pollution over the TMDL level needs to be reduced or eliminated to achieve clean water

Federal Clean Water Act Requirements
The Clean Water Act (CWA) established a process to identify and clean up polluted waters. The CWA requires each state to develop and maintain water quality standards that protect, restore, and preserve water quality. Water quality standards consist of (1) a set of designated uses for all water bodies, such as salmon spawning, swimming, and fish and shellfish harvesting; (2) numeric and narrative criteria to achieve those uses; and (3) an antidegradation policy to protect high quality waters that surpass these conditions.

The Water Quality Assessment and the 303(d) List
Every two years, states are required to prepare a list of water bodies that do not meet water quality standards. This list is called the CWA 303(d) list. In Washington State, this list is part of the Water Quality Assessment (WQA) process.

To develop the WQA, Ecology compiles its own water quality data along with data from local, state, and federal governments, tribes, industries, and citizen monitoring groups. All data in this WQA are reviewed to ensure that they were collected using appropriate scientific methods before they are used to develop the assessment. The WQA divides water bodies into five categories. Those not meeting standards are given a Category 5 designation, which collectively becomes the 303(d) list.

Category 1 – Meets standards for parameter(s) for which it has been tested.

Category 2 – Waters of concern.

Category 3 – Waters with no data or insufficient data available.

Category 4 – Polluted waters that do not require a TMDL because:

- 4a – Have an approved TMDL being implemented.
- 4b – Have a pollution control program in place that should solve the problem.
- 4c – Are impaired by a non-pollutant such as low water flow, dams, culverts.

Category 5 – Polluted waters that require a TMDL – the 303(d) list.

Further information is available at Ecology's Water Quality Assessment website.[23]

The CWA requires that a TMDL be developed for each of the waterbodies on the 303(d) list.

TMDL Process Overview

Ecology uses the 303(d) list to prioritize and initiate TMDL studies across the state. The TMDL study identifies pollution problems in the watershed, and specifies how much pollution needs to be reduced or eliminated to achieve clean water. Ecology, with the assistance of local governments, tribes, agencies, and the community, then develops a plan to control and reduce pollution sources, as well as a monitoring plan to assess effectiveness of the water quality improvement activities. The implementation plan identifies specific tasks, responsible parties, and timelines for reducing or eliminating pollution sources and achieving clean water.

TMDL evaluations are required to identify the maximum amount of each pollutant to be allowed into these water bodies so as not to impair beneficial uses of the water. The TMDL is then used to determine the (1) WLAs among sources with wastewater and stormwater permits and (2) LAs among various nonpoint diffuse sources that do not have permits. In the case of the Padilla Bay, the resulting TMDL technical report is used to develop FC TMDLs in the tributaries of the watershed. The TMDLs will set water quality targets to meet FC criteria, identify key reaches for source pollution, and allocate pollutant loads to nonpoint sources. The TMDL study was conducted by Ecology's Environmental Assessment Program with collaboration from Washington Department of Health, Skagit County, and other local entities. After the public comment period, Ecology addresses the comments. Then, Ecology submits the TMDL to EPA for approval.

Water Quality Data

The Skagit County Water Quality Monitoring Program (SCMP) was established in 2003 to track trends in water quality within the county's agricultural areas. Each sampling site is visited every two weeks to measure temperature, dissolved oxygen, FC, and other parameters to develop a comprehensive view of the status and trends in water quality at each site. Nutrient analysis is conducted on a quarterly basis.

In the Padilla Bay watershed, there is one downstream site in the three different sloughs that flow into Padilla Bay: Joe Leary, No Name, and Big Indian. All three sloughs are monitored to determine the status and trends at the downstream end of a watercourse in an agricultural area (Table A. 1).

[23]https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-improvement/Assessment-of-state-waters-303d

Table A. 1 - SCMP Site in the Padilla Bay watershed.

Water body	Site Number	Location Description	Latitude	Longitude
Joe Leary	35	D'Arcy Road	48.520	-122.462
No Name	34	Bayview – Edison Rd	48.468	-122.464
Big Indian	40	Bayview-Edison Rd	48.447	-122.457

Skagit County collects samples for FC every two weeks and submits samples to the Skagit County Health Department Water Lab or Edge Analytical for analysis using the Most Probable Number (MPN) method. Table A. 2 shows the results of these samples as geometric means for bacterial concentrations at each location and percentage of samples that exceeded the water quality criterion.

Table A. 2- Geometric mean (GM) measured in cfu/100 mL and percent of samples over 200 cfu/100 mL (%) for FC collected by SCMP for sloughs in Padilla Bay watershed during Water Years 2009 to 2013.

Site Name	Site Number	2009 GM	2009 %	2010 GM	2010 %	2011 GM	2011 %	2012 GM	2012 %	2013 GM	2013 %
Joe Leary	35	103	28	85	8	54	12	56	17	125	28
No Name	34	198	50	216	42	102	38	110	42	131	31
Big Indian	40	132	40	122	38	104	23	55	15	43	15

SCMP calculates the Water Quality Index (WQI) score for monitored sites. The Washington Department of Ecology developed the WQI as an overall indicator of water quality. It is a unitless number ranging from 1 to 100. A higher number is indicative of higher water quality. For temperature, pH, FC, and dissolved oxygen, the index expresses results relative to levels required to maintain uses according to criteria specified in WAC 173-201A. For nutrient and sediment measures, where standards are not specific, results are expressed relative to expected conditions in a given region. Multiple constituents are combined and results aggregated over time to produce a single score for each sample station. In general, stations scoring 80 and above, meet expectations for water quality and are of "lowest concern." Scores from 40 to less than 80 indicate "marginal concern." Scores below 40 do not meet expectations and are of "highest concern" (Hallock, 2002).

The WQI summarizes raw data and is useful for comparing sites and for answering general questions about water quality. However, the WQI has limitations which make it less useful in answering specific questions. For example, a water body may be impaired by constituents not included in the index. Another limitation of the WQI is the reliance on ambient data. Some sites on the Samish River, located near Padilla Bay, have adequate WQI scores based on ambient sampling. These same sites are severely impaired during storm flows (Skagit County Public Works, 2013). Another limitation of the WQI is that aggregation of data may conceal or exaggerate short-term water quality problems (Hallock, 2002).

Shellfish Bed Protection

DOH collects and analyzes FC to protect consumers from eating contaminated shellfish. Shellfish beds are located approximately 3 miles to the north of the Joe Leary Slough outlet. The National Shellfish Sanitation Program (NSSP) prescribes two methods to evaluate bacteria levels in shellfish harvesting areas: Systematic Random Sampling (SRS) and Adverse Pollution Conditions (APC). Both use a minimum of 30 samples. DOH uses a multiple tube fermentation procedure with A-1 broth (method 9221 E in APHA, et al., 2006). DOH applies the following criteria, which are identical to Ecology's criteria in the Water Quality Standards:

1 The concentration of FC cannot exceed a geometric mean of 14 organisms per 100 milliliters (14 organisms/100 mL)

2 The estimated 90th percentile cannot exceed 43 organisms/100 mL

If either of the predefined methods is exceeded, no shellfish can be directly harvested from the area around that marine water station (Figure A-2). A shellfish growing area is classified as Conditionally Approved if NSSP water quality criteria are met, except during pollution events that are episodic and predictable, such as rain-related runoff. An area is classified as Restricted (Figure A-3) if it is subject to limited pollution. Shellfish from Restricted Areas cannot be harvested directly. They may be "relayed" under strict supervision to clean waters for natural cleansing.

DOH collects monthly marine data in Padilla Bay for FC, temperature, and salinity. DOH has used seven sites in eastern Padilla Bay (only two are currently active). DOH uses data to analyze the status and trends in FC pollution in shellfish growing areas. To perform the analysis, DOH uses "estimated 90th percentiles." DOH developed a "fecal pollution index" (FPI) as a simple tool to quantify fecal pollution impact. The FPI is a unit-less number that describes the degree of fecal pollution. The FPI ranges from 1.0 (100% of 90th percentiles are GOOD, i.e., negligible impact) to 3.0 (100% of 90th percentiles are BAD, maximum impact). The FPI may be applied at the level of the sampling station, growing area, or over larger regional areas (DOH, 2011).

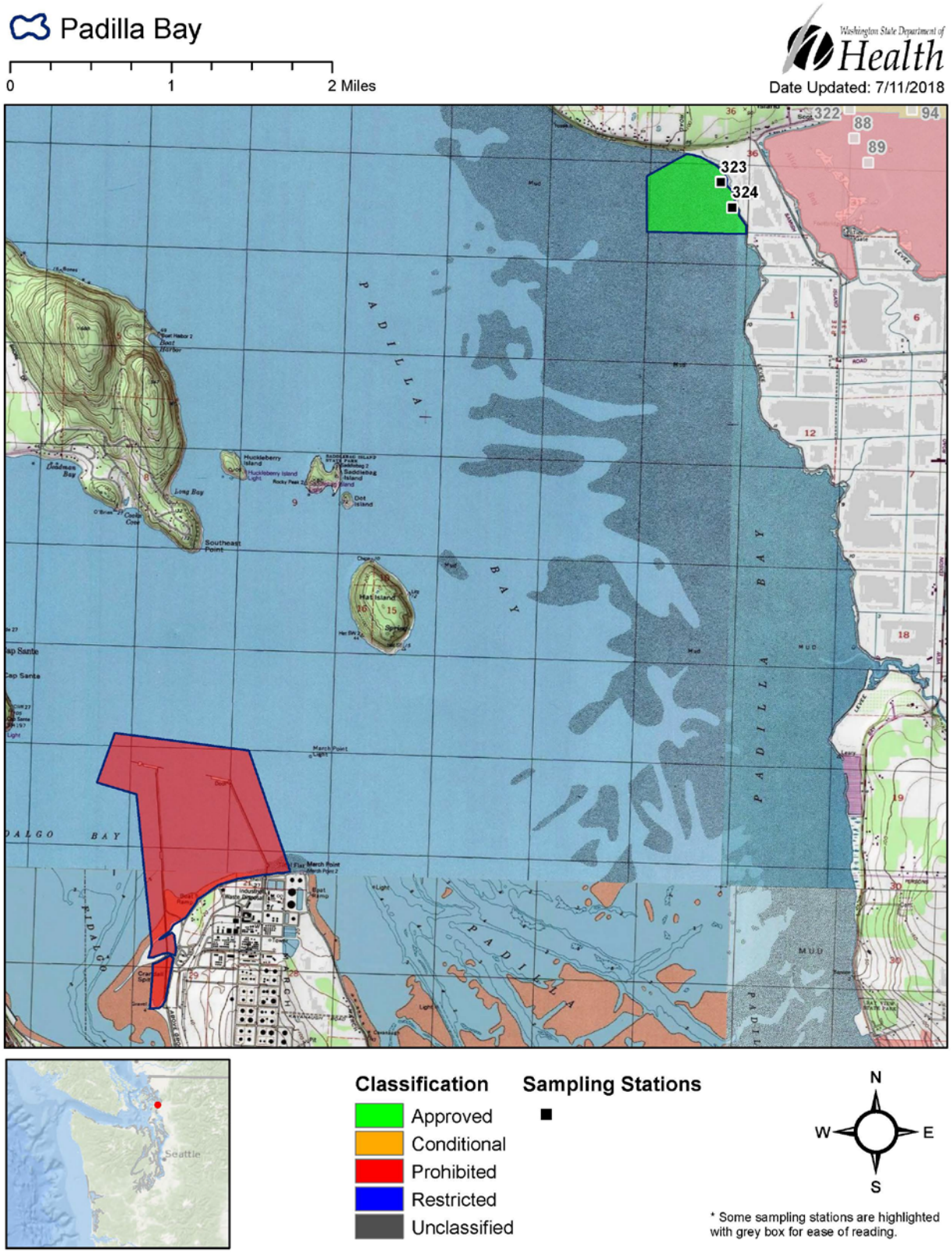


Figure A. 1 - Commercial shellfish growing area in northern Padilla Bay is currently fully approved

Figure A. 2 - Recreational shellfish harvesting is currently prohibited year round at Bayview State Park and on the eastern shoreline at March Point Recreation Area

Protection of Designed Uses

For this study, Ecology focused on reducing FC bacteria at freshwater sites throughout the eastern Padilla Bay watershed. This approach ensures that downstream uses will be protected. Justification for this method includes the increased bacteria die-off in marine waters, high mixing zones and low residence times in Padilla Bay, and distance from shellfish harvesting beds (Fields, 2016; Bulthuis, 2013; Sargeant et al., 2006; Mancini, 1978). Detailed modeling of mixing, residence time, and tidal dynamics were not completed as a part of this TMDL.

Appendix B: Public Participation

Public Comment

The Padilla Bay TMDL kick off meeting was held on October 1st, 2015. This meeting was publicized in the Skagit Valley Herald, as well as the GoSkagit website.

Portions of the TMDL were made available to the technical advisory team members to review and provide edits in September 2020, with additional discussion occurring during the team meetings. Representatives from organizations outlined as having a role in implementing this TMDL were invited to participate in guiding and selecting implementation targets and priorities.

A 30-day public comment period was held on this TMDL and implementation plan from 10/22/2020 to 11/22/2020. Two virtual public meetings were held on 10/28/2020 to provide information to the public, and provide an opportunity to address questions. Slides from this meeting are included as figures B-1 through B-6.

Ecology released a Blog[24] post regarding the TMDL on October 22nd, 2020.

A news article titled "State details Padilla Bay bacteria issue[25]" was published by GoSkagit on October 23rd, 2020.

A presentation was made to the Skagit County Agricultural Advisory Board on November 18th, 2020. This presentation and question and answer session provided information related to the report, the TMDL process, and the proposed implementation efforts.

An additional article titled "New report details action plan for fixing Padilla Bay fecal coliform sources, urges participation[26]" describing the TMDL was published in the Salish Current Newsletter on November 20th, 2020.

[24] https://ecology.wa.gov/About-us/Get-to-know-us/News/2020/Oct-22-Padilla-Bay-Tributaries
[25] https://www.goskagit.com/news/environment/state-details-padilla-bay-bacteria-issue/article_069ee621-bb4a-5cea-9fcf-5b1ab9c57a86.html
[26] https://salish-current.org/2020/11/20/new-report-details-action-plan-for-fixing-padilla-bay-fecal-coliform-sources-urges-participation/

Figure B-1 – Ecology October 28th 2020 public meeting slides 1 – 8

The Padilla Bay Tributaries

- Northwest Skagit County
- Includes the area West of the City of Burlington to the community of Bay View.
- The Padilla Bay freshwater TMDL focuses on 4 tributaries:
  - No Name Slough
  - Big Indian Slough
  - Little Indian Slough
  - Joe Leary Slough

Tributaries overview

- It consists of four major sloughs and many interweaving drainage systems.
- The watershed is relatively flat with high water tables, making drainage a challenge for communities in the watershed.
- These tributaries drain roughly 9,300 ha (22,980 acres).

Padilla Bay Freshwater Tributaries TMDL timeline

2016 — TMDL process started

Padilla Bay was selected as a TMDL location due to local interest and efforts, as well as previous assessment data

2016-2018 — Additional data collection and analysis

-Water quality samples were taken over a two year period
-Data was evaluated and used to develop TMDL values.

2019-2020 — TMDL report development and submittal

-Initial draft was completed in April 2019 - Project delayed by other project and efforts – Technical report published

-Updated draft completed in May of 2020, with goal of completing TMDL process by the end of 2020.

What is a Total Maximum Daily Load?

- A Total Maximum Daily Load, or "TMDL" can be compared to a diet.
- It is a pollution diet, where the end goal is to reduce the level a pollutant and restore the health of the Padilla Bay freshwater tributaries.

Why does Ecology develop TMDLs?

- The Clean Water Act requires that state environmental agencies complete TMDLs for impaired waters. The United States Environmental Protection Agency (EPA) reviews and approves / disapproves those TMDLs.
- TMDL is a plan for restoring impaired waters that identifies the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards.

The TMDL Process

Assess the state's waters
↓
List those that do not meet standards
↓
Identify sources and reductions needed (TMDL Study)
↓
Implement restoration activities (Implementation Plan)
↓
Evaluate water quality

Water quality standards

State agencies are required per the Clean Water Act to develop:

- Designated Uses
- Water quality criteria – Including a narrative description and numeric criterion
- Anti-degradation policies/information

Designated uses and standards

- Currently, the Padilla Bay freshwater tributaries do not meet the bacteria state water quality standards for Recreational Use – Primary Contact.
- *"Fecal coliform organism levels must not exceed a geometric mean value of 100 colonies/100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 colonies/mL."* [WAC 173-201A-200(2)(b)]

Freshwater Standard	Geometric mean (cfu/100 mL)	Statistical threshold value (cfu/100 mL)
Padilla Bay freshwater tributaries	100	200

Geometric mean

- How does Geometric mean different from the arithmetic Mean or average value?
- Sample results
  - 10
  - 10
  - 10
  - 1000
- The Arithmetic Mean is 275.5
- The Geometric mean is 31.6

Figure B-2 – Ecology October 28th 2020 public meeting slides 9 – 16

Assessment and impairment/303d

- Ecology compiles our own water quality data, and invite other groups to submit water quality data they have collected.
- Once the assessment is complete, the public is given a chance to review and give comments.
- The final assessment is formally submitted to the Environmental Protection Agency for approval of the category 5 listings, also called the 303(d) list.

TMDL area and listings

- The existing 303d assessment data was used (2014).
- An additional two years of sample data were collected.
- Additional impairments were identified through this assessment.

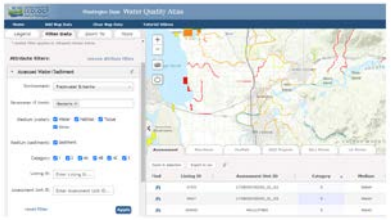
303d listings used within the TMDL

Listing ID	Waterbody Name	Pollutant	Medium	Reach Code (Assessment Unit ID)
45711	Big Indian Slough	Bacteria	Freshwater	17110002000331
*TBD1	Big Indian Slough	Bacteria	Freshwater	17110002000720
*TBD2	Big Indian Slough	Bacteria	Freshwater	17110002001375
*TBD3	Big Indian Slough	Bacteria	Freshwater	17110002001367
7158	No Name Slough	Bacteria	Freshwater	17110002000314
39608	Joe Leary Slough	Bacteria	Freshwater	17110002001748
39607	Joe Leary Slough	Bacteria	Freshwater	17110002000523
16410	Joe Leary Slough	Bacteria	Freshwater	17110002000031
*TBD4	Little Indian Slough	Bacteria	Freshwater	17110002000687

* New waterbody segments determined to be impaired by this study

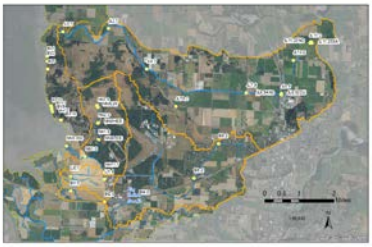
Water Quality Atlas

- Water Quality Atlas
- Contains information about current listings and impairments
- Search by Text or Map



Data used within the TMDL

- Samples were collected at 28 locations.
- Goal of 20 samples per location. (12-23).
- Bay View outfalls were sampled.



The TMDL calculation methods

- $TMDL = \sum WLA + \sum LA + MOS + RC$

What does that mean?

- Lets break down what the WLA, LA, MOS, and RC values include.

TMDL values

- TMDL - Based on flow data, how much bacteria can be in the water and meet the standards
- Measure the amount water in the watercourse (flow), and determine how much pollutant it can have and still meet the standards.

Sources - Waste Load Allocation

- Waste Load Allocation (WLA) is a summary of all known "point sources" (end of pipe) discharges from permitted facilities.
- Point source dischargers are required to comply with conditions in a water quality permit before they discharge.
- Permits include
  - Municipal Separate Storm Sewer System (MS4)
  - Construction Stormwater General Permit
  - Sand & Gravel General Permit
  - Stormwater general permits
  - Water Treatment Plant General Permit

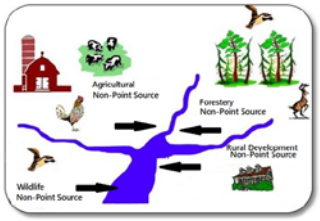
Figure B-3 – Ecology October 28th 2020 public meeting slides 17 - 24

Margin of Safety and Reserve Capacity

- Margin of Safety - is intended to allow a safety buffer between the calculated TMDL and the actual load that will allow the water body to meet its beneficial use.
  - This can use a percentage of the TMDL value (explicit value), or used to account for uncertainty in the data or modeling used in the TMDL (implicit).
- Reserve Capacity – This value is included to account for future growth or permitted sources.
  - A 10% value was used within the TMDL, based on growth in Skagit County.

Sources - Load Allocations

- The remaining portion of the load is attributed to non-point sources.
- Nonpoint sources are diffuse sources of bacteria throughout the watershed or TMDL boundary area.

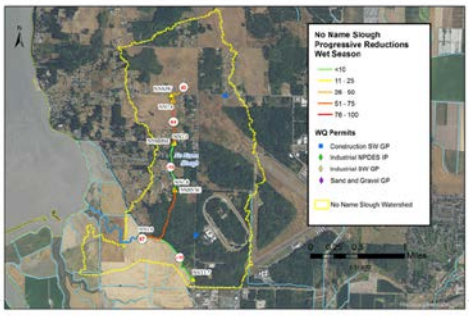


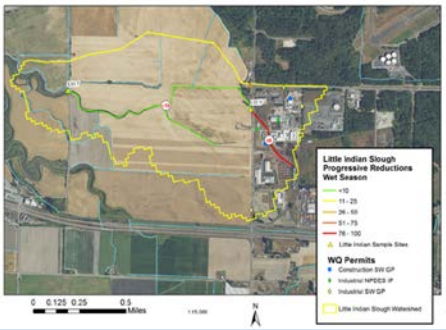
The TMDL values

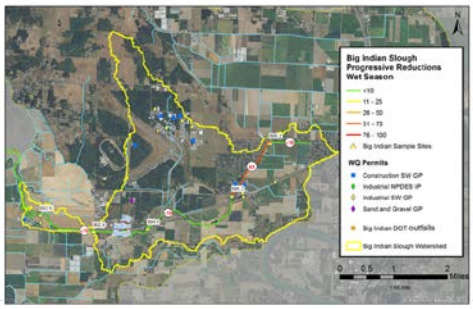
Calculated allowable volume (TMDL)
=
Sum of permitted sources (WLA)
+
Uncertainty value (MOS)
+
Value for future growth (RC)
+
Non-point sources (LA)

Reductions – TMDL vs observed

- Reductions are shown using a "progressive" or "cascading" calculation.
  - If you reduce upstream concentrations/loading, you will need to reduce less downstream.
  - The TMDL document contains both the progressive and individual reductions.
- Seasons will impact bacteria levels in each individual slough. Reduction values are calculated for the Wet (October-April) and Dry (May-September) seasons.







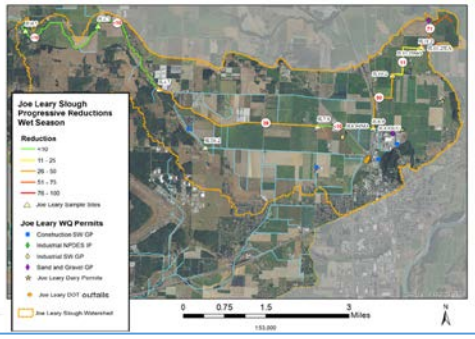
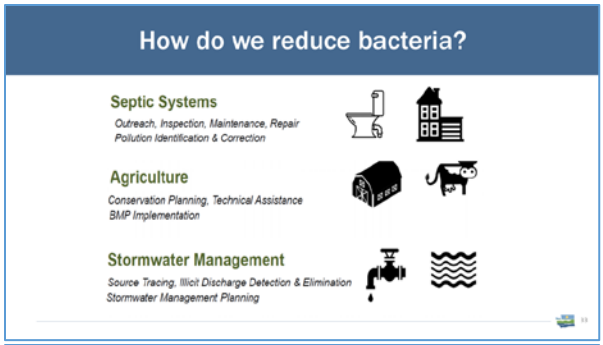
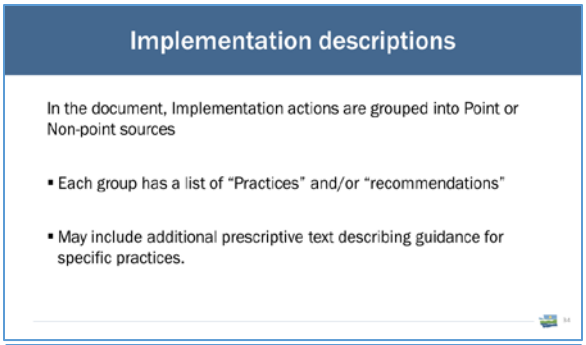
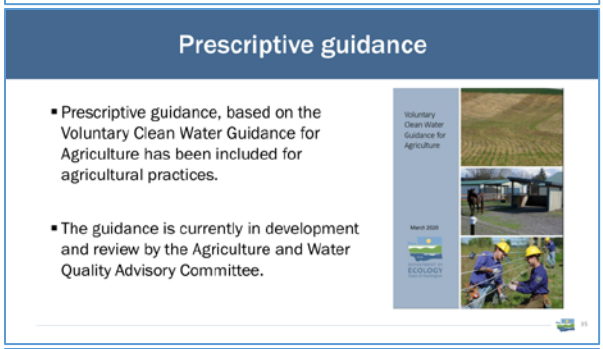
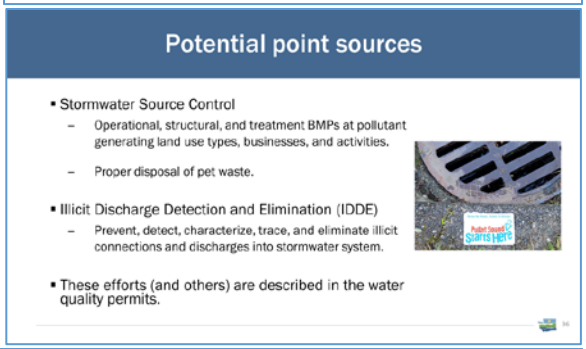


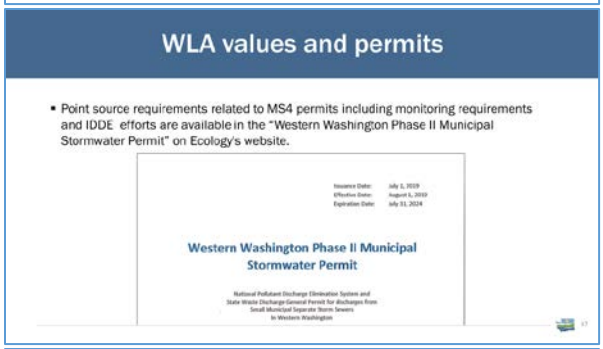
Figure B-4 – Ecology October 28th 2020 public meeting slides 25 - 32

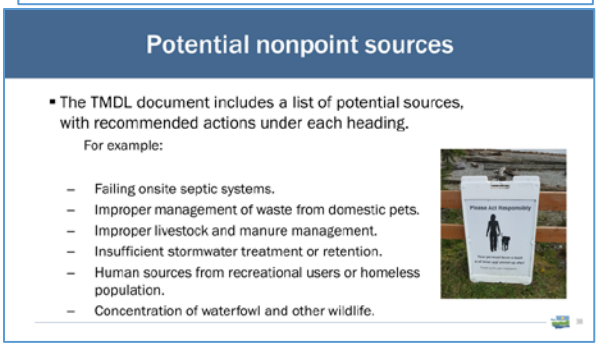


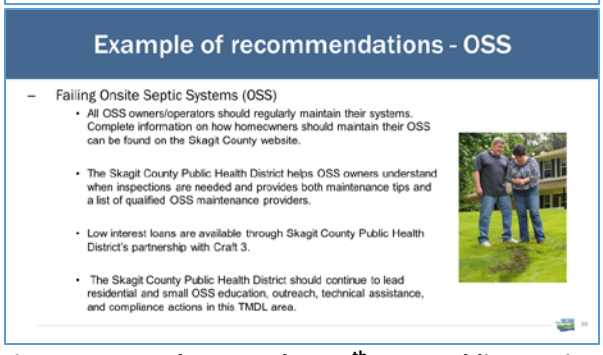












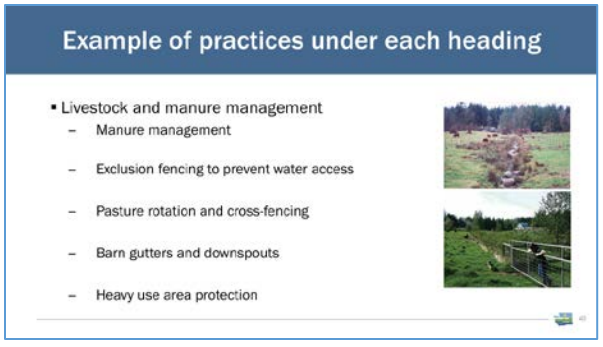
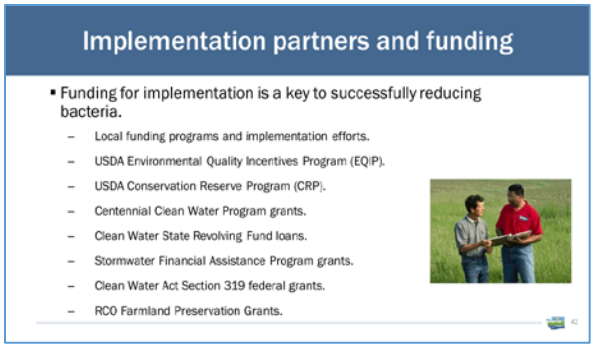
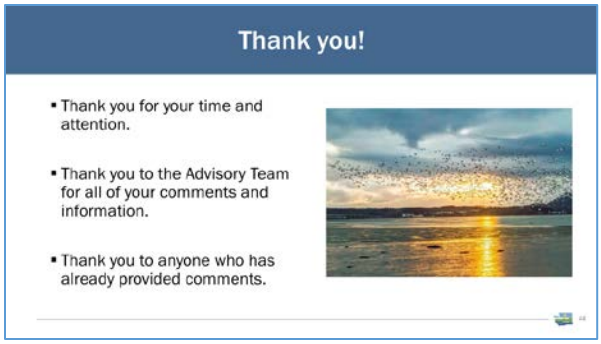
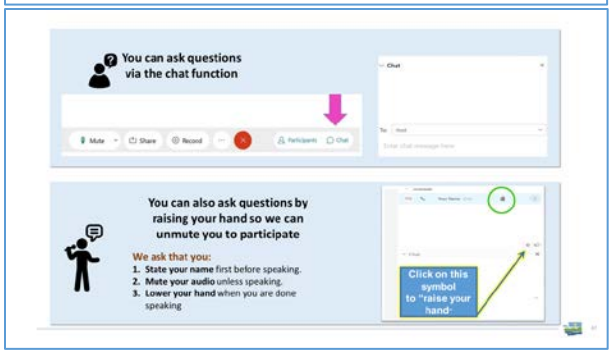


Figure B-5 – Ecology October 28th 2020 public meeting slides 33 - 40







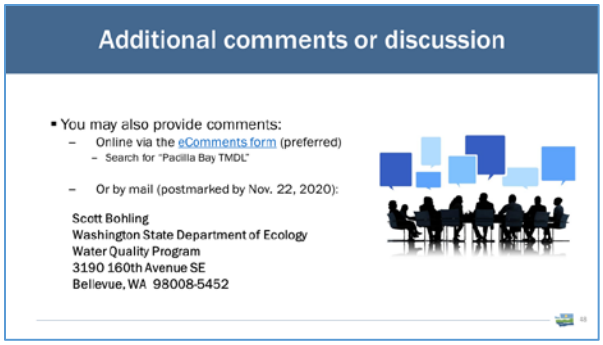


Figure B-6 – Ecology October 28th 2020 public meeting slides 41 - 48

Comments and Response

Note: The following summarized comments were received during the public comment period for the Padilla Bay Freshwater Tributary Fecal Coliform TMDL Water Quality Improvement Report and Implementation Plan. Comments regarding factual inaccuracies, improved wording, or those that clarify policy positions by other government agencies have been directly incorporated into the text of this report. Some comments have been combined in order to avoid redundant responses to similar or related comments. Some comments addressed multiple regulatory or programmatic topics within a single comment, and these comments have been separated and are indicated by the presence of the word "Abridged" within parenthesis at the start of the comment. All other comments are summarized below.

1 - *Comment:* (Abridged) Ecology only hosted two Advisory Group meetings prior to the release of the Draft TMDL Report for public review. These meetings were held in September and October of 2020 and did not allow adequate time for Advisory Group members to discuss or address comments raised by participants. Ecology did not grant an extension or request an extension from EPA and as a result, Advisory Group and public participation and awareness was extremely limited.

Similar Comment – Related topic: The report states that "Ecology developed this implementation plan and timeline, and worked with interested parties through an advisory group process to refine the goals and approach". There were only two meetings where ECY provided a presentation and there was limited time for advisory group involvement.

Similar Comment – Related topic: Skagit County is deeply concerned about the lack of involvement of the Technical Advisory Group before releasing the document for public review. There have been only two presentations to the TAG with limited time for input. In addition, the "Eastern Padilla Bay Tributaries Fecal Coliform Bacteria Total Maximum Daily Load Study: Water Quality Study Findings" was not shared or reviewed by the TAG nor Skagit County prior to its incorporation into the TMDL document.

Response: Based on the public participation requirements described within the CWA, this TMDL has met all obligations through virtual public meetings, and making the report available for the 30-day public comment period. Ecology does prefer to engage in a more robust, in-depth process which allows additional feedback, guidance, and direct engagement with local stakeholders. Unexpected assignments, staff turnover, and limitations due to Covid19 impacted the overall timeline of the project.

Ecology is committed to help implement a community supported strategy to manage and control bacteria sources. Identifying durable, community supported solutions helps with implementation efforts. Ecology is committed to continue to engage and facilitate discussions in 2021 to support efforts to address pollution in the Padilla Bay TMDL area. Additional efforts to discuss data collection, analysis methods, and incorporating existing successful methods may

be helpful. Similarly, approaches and lessons learned within other local efforts, such as the Clean Samish Initiative, can be adopted where it is applicable.

2 - *Comment*: Very high bacteria levels, especially in No Name and Joe Leary have been known for many years from sampling by the Conservation District - Padilla Bay Stream team and Storm teams. The only significant effort to reduce that bacteria pollution has been via the County authority to proactively require working septic systems. Bayview homeowners have spent millions of dollars for those upgrades but still the bacterial pollution continues. Everything else has been "pollyanish" newsletters about all the good work happening with no actual improvement actions or improvements in bacteria pollution levels described.

Response: The Padilla Bay Freshwater Tributary Fecal Coliform TMDL builds on the information noted in this comment and provides greater detail on pollution loading throughout the watershed. This information, along with the continued data collection efforts by Skagit County, will be valuable to guide ongoing water cleanup efforts. Ecology recognizes that it is frustrating for people to see ongoing pollution problems not get immediately resolved. Many of the larger, well known, and highly visible livestock pollution problems are being resolved using both technical assistance and enforcement pathways.

Ecology will continue to conduct storm event monitoring in cooperation with local partners and review other data sources to gather information on where pollution is coming from, determine if a particular site is contributing, or document conditions on known sites that continue to pollute to build enforcement cases. We believe that the combination of direct action on observed sources of pollution, continued source identification work, and outreach/education is working and will be successful in resolving bacterial pollution problems in this watershed.

3 - *Comment:* There have been times when citizens have filed formal ERTS with Ecology and informal reports, with pictures, to the County about livestock in wet conditions where obvious manure runoff into No Name and Joe Leary is happening. Ecology and the County do not proactively look for that. Any response to the reports has been short lived and the same reports need to be done by citizens again and again. Right now it is November and much rain is on the way for our rainy season. There are hundreds of cattle in fields where No Name and Joe Leary flow through and there is no confidence that either the County of Ecology will be aware of that and/or take any action.

Response: Ecology does conduct proactive roadside surveys in selected areas of Skagit County and prioritizes the most serious problem sites for follow-up. Because of the large area we cover, and the fact that only an estimated one third of properties can be observed from roadsides, we and our partner agencies rely upon and greatly appreciate complaint reports from the public to our Environmental Response Tracking System (ERTS). Ecology has to operate within the bounds of the law and respect private property laws as part of our survey process. Nonpoint pollution is one of the most notoriously difficult types of pollution to find, document, and resolve.

Due to the nature of ERTS responses and overlapping jurisdictions, much of the investigative work being conducted is not public facing. Several properties in the Padilla Bay Freshwater Tributary TMDL area are in the process of being worked through the technical assistance and enforcement processes. While these efforts are often slow, Ecology is committed to adequately document site conditions, provide opportunities for assistance, and allow adequate time to allow the installation of practices before formal enforcement begins.

4 - *Comment:* The TMDL really needs much more specific, parcel-unique actions prescribed - with specific time-lines and serious repercussions if not taken. Expecting the County or the Conservation District - neither of which have any regulatory capacity about this - to get anything done is not hopeful - especially since the problems have been known for so many years by these organizations.

Response: Ecology recognizes that site-specific solutions are needed when problems are identified. Information used to develop the cost estimate portion of the TMDL was based on a parcel-scale level analysis of the tributary watersheds using publically available data and aerial photography. However, additional verification of site-specific conditions will be necessary before any implementation actions are recommended or required. When it becomes necessary, enforcement actions must be based on well documented conditions. Ecology is committed to working with landowners where pollution problems are found starting with technical assistance and development of a schedule for implementing corrective best management practices. Ecology has and will continue to use formal enforcement tools, including orders and penalties, to ensure state waters are protected when technical assistance is unsuccessful in solving pollution problems.

We recognize the specific authorities and roles of Skagit County and the Skagit Conservation District, who are crucial partners to restoring Padilla Bay Tributaries to good health, and we believe the education and outreach, technical and financial assistance they provide is an essential element in helping many landowners take action to prevent and correct pollution problems on their properties.

5 - *Comment***:** WSDOT is interested in having higher-level discussions with Ecology regarding inconsistencies across the state on TMDL approaches, wasteload (WLA) vs. load allocation (LA) calculations and assignments, and NPDES implications. WSDOT seeks additional clarification on existing policies for TMDL development related to these topics, especially related to WLAs vs. LAs, as demonstrated by the following comments.

Response: While the higher-level discussion is beyond the scale of this TMDL, developing a consistent, standardized approach to calculating and assigning WLA and LA values would be beneficial to both Ecology and WSDOT. Ecology staff can work to schedule meetings with WSDOT to discuss TMDL requirements, current methods, and the development of standard methods and language.

6 - *Comment*: Per page 23, “Wasteload allocations (WLAs) are determined for point sources of pollutants, that are regulated under the National Pollutant Discharge Elimination System (NPDES) permit…WLAs are developed as part of a TMDL when National Pollutant Discharge Elimination Systems (NPDES) regulated stormwater discharges are present …and contribute to pollutant loading.” Based on this, the sentence referenced from page 25 should be clarified to explain the majority of WSDOT facilities within the TMDL boundary are not subject to the WLA as they are outside of WSDOT’s MS4 Permit coverage area.

> *Recommendation:* Suggest editing language to state, “Washington State Department of Transportation (WSDOT) highways and facilities are also covered under an MS4 permit within Phase I and II areas.” Suggest referring to Figure E.1 in this section to provide clarity. 2. (p. 31, Table 12)

Response: Language within the TMDL has been edited to state, "Washington State Department of Transportation (WSDOT) highways and facilities are also covered under an MS4 permit within Phase I and II areas plus any TMDL areas that may be outside the Phase I and II permit areas (refer to Appendix E, Figure E.1 for additional information)."

7 - Comment: (p. 56, last paragraph) “WSDOT permits cover highway systems running through the study area, and these include Interstate Highway 5 (I-5), Washington State Route 11, State Route 20, and State Route 536.”

It is unclear if the receiving waters and WLAs listed cover all WSDOT facilities within the TMDL boundary or just the facilities subject to WSDOT’s MS4 Permit. This comment is related to comment #1, #3 and #8, as it appears Ecology is using all WSDOT facilities within the TMDL boundary for WLA calculations, which is not consistent with the text on page 23 that describes what a WLA is and when it is applicable. In addition, WSDOT’s MS4 Permit is not technically a Phase II permit. The WQWebPortal and PARIS both refer to WSDOT’s permit type as "Municipal SW GP”.

> *Recommendation:* Suggest only including waterbodies in Table 12 that receive discharges from WSDOT’s facilities within the permit coverage area. Also, suggest removing “Phase II” from Table 12. 3. (p. 56, last paragraph) “WSDOT permits cover highway systems running through the study area, and these include Interstate Highway 5 (I-5), Washington State Route 11, State Route 20, and State Route 536.”

Response: Language and tables within the TMDL have been edited to reflect the recommendations made with the comment. WSDOT MS4 permit areas include the areas within the Phase I and II permit coverage areas plus any TMDL areas that may be outside the Phase I and II permit areas. WSDOT must have WLA where the approved TMDL has identified WSDOT

as a load contributor and has identified and assigned action items for WSDOT highways and facilities. Refer to Special Condition S1.B.2 of the WSDOT MS4 permit number WAR043000A.

8 - *Comment*: State Route 11 is not subject to WSDOT's MS4 Permit and only sections of the other WSDOT roadways referenced are within WSDOT's MS4 Permit coverage area and within the TMDL boundary. While WSDOT does implement some MS4 permit requirements programmatically statewide (on roadways not subject to MS4 Permit), it doesn't seem prudent to use facilities outside the MS4 Permit area to calculate the WLA.

> Recommendation: Suggest editing language to state, "WSDOT's MS4 permit covers highway systems running through the study area, and these include sections of Interstate 5 (I-5), State Route 20, and State Route 536."

Similar Comment – Related topic: (p. 74, second paragraph under WSDOT heading) "A WLA for WSDOT infrastructure and right of way areas within the Padilla Bay Watershed is provided in this TMDL."

Should be clarified consistent with comment #1.

> *Recommendation:* Suggest editing language to state, "A WLA for infrastructure and right of way areas subject to WSDOT's MS4 permit within the Padilla Bay Watershed is provided in this TMDL."

Similar Comment – Related topic: (p. 125, first paragraph) "WSDOT permits cover highway systems running through the study area, and these include Interstate 5 (I-5), Washington State Route 11, State Route 20, and State Route 536."

> *Recommendation*: Same as recommendation #3.

Similar Comment– Related topic: (p. 125, Table E-6) State Route 11 is not subject to WSDOT's MS4 permit so it is unclear why it is included in this table with WLA calculations. Furthermore, it is unclear if the acreage values for the other roadways listed represent MS4 subject roadways or all WSDOT roadway surfaces within the TMDL boundary, which would be considered a nonpoint source that would be subject to a load allocation rather than a WLA.

> *Recommendation*: Please clarify the WLA calculations and assignments for WSDOT throughout the TMDL document, ensuring WLAs are calculated and assigned to WSDOT highways and facilities within the MS4 permit coverage areas only.

Similar Comment– Related topic: (p. 128, Table E-9) It is unclear if the values used for WSDOT are appropriate. This comment is related to comment #8.

> *Recommendation:* Please clarify the WLA calculations and assignments for WSDOT throughout the TMDL document.

Response: Per the previous comment, WSDOT MS4 permit areas include the areas within the Phase I and II permit coverage areas plus any TMDL areas that may be outside the Phase I and II permit areas. WSDOT must have WLA where the approved TMDL has identified WSDOT as a load contributor and has identified and assigned action items for WSDOT highways and facilities. State Route 11 is correctly included in the WLA calculation. The current language will remain unchanged.

9 - *Comment:* (p. 56, last paragraph) "This TMDL expects basic WSDOT permit conditions will control much of the fecal coliform bacteria discharged to the Padilla Bay watershed." Clarification needs to be added that this statement applies within the Phase II MS4 permit coverage area and that existing permit conditions are expected to be adequate to comply with the TMDL WLAs.

> *Recommendation:* Suggest editing language to state, "This TMDL expects that implementation of existing WSDOT permit conditions will control much of the fecal coliform bacteria discharged from WSDOT highways and facilities within the Phase II MS4 permit coverage area to comply with assigned WLAs in the Padilla Bay watershed."

Response: Language within the TMDL has been edited to include the language, "This TMDL expects that implementation of existing WSDOT permit conditions will control much of the fecal coliform bacteria discharged from WSDOT highways and facilities to comply with assigned WLAs in the Padilla Bay watershed."

10 - *Comment:* (p. 74, first sentence under WSDOT heading) "WSDOT actively implements a number of BMPs that can reduce local bacteria levels as part of their existing NPDES permit." This sentence is misleading because there are no approved BMPs for reducing bacteria levels identified in Ecology's Stormwater Management Manuals or WSDOT's Highway Runoff Manual. When a WSDOT ferry terminal or public rest area exists within a bacteria TMDL boundary, we have installed pet waste station BMPs, however, none of those facilities exist within this TMDL boundary.

> Recommendation: Suggest deleting this sentence from the draft TMDL.

Response: To ensure readability in the paragraph, the language within the TMDL has been edited to read, "WSDOT pollution control and prevention measures for state roads and highway runoff in its Municipal Stormwater NPDES Permit Stormwater Management Program Plans (SWMPPs) includes…"

11 - *Comment:* (Abridged) Although Districts 12, 14, and 19 each have easements over the watercourses subject to the TMDL, Ecology did not coordinate with them directly as a stakeholder in the TMDL process. In addition, the Consortium, which broadly represents all

member special purpose districts was not informed of the TMDL until September 9, 2020 and then it was only as it pertains as our role as the administrator of the District 19 MS4 permit.

Response: Ecology received several comments recommending additional coordination with the agricultural community. We believe that our advisory group meetings and public process provided good information on our study and broad scale expectations for targeting water cleanup actions. At the same time, we agree that more conversation and coordination with the agricultural community can further refine implementation actions and expectations. Ecology commits to continuing direct discussions with the Drainage District Consortium in early 2021 and to creating an addendum to the approved TMDL if needed. The Padilla Bay TMDL kickoff meeting with the community on October 1st, 2015 invited as many drainage district commission members as we could identify. Many changes in staff and board members may have occurred since that date potentially resulting in less than optimal communication with the agricultural community.

12 **-** *Comment:* (Abridged) Both Western Washington Agricultural Association (WWAA) and the Skagit County Drainage and Irrigation Districts Consortium (Consortium) identified concerns regarding the classification of the freshwater tributaries and use of the primary contact recreation criteria as the basis for the 303(d) listing and subsequent Draft TMDL. Ecology has not provided any documentation to suggest that a local process was used to establish "primary contact recreation" criteria for these waterbodies.

All of the freshwater tributaries identified in the Draft TMDL Report are managed by Special Purpose Drainage and Irrigation Improvement Districts for drainage and irrigation purposes. Specifically, District 12 manages the lower reaches of No Name Slough, District 14 manages Joe Leary Slough, and District 19 manages Big Indian Slough. These districts were formed at or near statehood in the late 1800s and early 1900s and were granted authorities under the Revised Code of Washington Title 85. In addition to these authorities, each districts hold easements over these waterbodies precluding any recreational use.

In addition to the easements that preclude recreation; the physical condition of these sloughs also precludes primary contact recreation as defined in WAC 173-201A. The Draft TMDL Report does not acknowledge the role and authorities of Special Purpose Districts as it pertains to this Draft TMDL, nor has Ecology given any consideration to the actual physical condition of the tributary waterbodies, nor any justification of the use of this criteria being applied to the freshwater tributaries.

Response: This detailed comment appears to focus primarily on Ecology's process for designating uses for state waters and our authority and procedures for addressing impairments through the TMDL process. Ecology believes it has followed its legal mandates and authorities and has properly applied them to the waters of the Padilla Bay tributaries. While Ecology acknowledges the existence and authority of the legally established districts, we are not aware of any element(s) in Title 85 that would preclude Ecology from the application of Clean Water

Act requirements or authorities granted under state statutes (RCW 90.48) or regulations (WAC 173-201A).

The State Surface Water Quality Standards (SWQS) were initially developed and placed into rule through state rulemaking laws established by the Washington State Legislature and were subject to public comment. All subsequent updates to this rule, including the 2019 update to bacterial indicators for the recreational uses and criteria, were established through the same public process. The comment refers to a lack of local process in establishing the SWQS rule. We are not aware of any legal requirement, outside of what is mandated by the state Administrative Procedures Act, that the department was required to follow to in order to establish and revise the water quality standards. As part of the SWQS rulemaking subsequent to the Clean Water Act (circa 1972), the federal law required that state rules assign designated uses to all waters of the state, and associated water quality criteria to protect those uses.

Section 303(c) of the Clean Water Act requires all states to develop water quality standards and antidegradation policies to ensure the protection of designated uses. These uses include protection for human health and aquatic life for all waters of the state. Ditches and other manmade waters are considered waters of the state in accordance with the statutory definition in RCW 90.48.020. This was confirmed by Attorney General Slade Gordon in a 1967 opinion, stating that waters of the state "included water found in canals, drains, wasteways and reservoirs of irrigation and drainage systems."

Section 101(a)(2) of the Clean Water Act requires that criteria be developed to ensure that all waters are swimmable and fishable. Bacteria criteria are developed to protect fish/shellfish harvesting and primary contact recreation. This is the baseline requirement for all waters in the state and was the context when Washington initially set the designated uses for the state. It is important to note that this is a baseline requirement for all waterbodies regardless of whether the uses are actively occurring at all times or not. At this time, the baseline requirements of swimmable and fishable uses were applied to all state waters.

The freshwater tributaries included in the Padilla Bay TMDL meet the criteria based on the following:

- *These waterbodies meet both definitions as Waters of the State under RCW 90.48 and Waters of the United States and are subject to the Clean Water Act regulations.*
- *Although ownerships and easements of the terrestrial and aquatic land exist, the water on or passing through those lands are state waters and are subject to State Surface Water Quality Standards as defined in WAC 173-201A.*
- *These sloughs may be partially or wholly channelized, however, human created and highly managed waterways remain waters of the state in accordance with RCW 90.48.020.*
- *SWQS use designations for recreation and all other designated uses were established in 1967. At that time, the definition that directed where designated uses applied was: "Waters of the State" or "state's waters" or "Interstate Waters" shall mean the entire stretch within the State of Washington or all rivers, lakes, and other waters that flow*

across or form a part of the state or international boundaries anywhere along their length including coastal waters. "Coastal Waters" are further defined as the ocean waters along straight coasts and the waters along indented coasts which are subject to the ebb and flow of the tides".

Special use designations were applied to some waters including site specific numeric criteria and special use designations such as "secondary contact recreational uses". Although some special conditions for specific criteria were establish at that time in the Skagit Basin, no exceptions to the designated recreational uses were made in the Skagit Basin. Even if the water contact recreation uses of these slough was reduced to secondary contact, the more stringent downstream designated use of shellfish harvesting, which is regulated by fecal coliform concentrations, would be required to be met per WAC 173-201A-260(3)(c): "Upstream actions must be conducted in manners that meet downstream water body criteria. Except where and to the extent described otherwise in this chapter, the criteria associated with the most upstream uses designated for a water body are to be applied to headwaters to protect nonfish aquatic species and the designated downstream uses."

Regulations governing impaired waters and TMDLs are in Part 130.7 in the Code of Federal Regulations (CFR). Issued in 1992, the regulations stipulate that states are to continue to identify waters that require TMDLs and ascertain the pollutants causing or expected to cause the impairment based on readily available data and information. States are to include in their impaired waters report a description of the method used to develop the list, the data and information used, and the decision rationale. States establish a priority ranking to put in place plans for establishing a total pollutant load and parse out the load from point (the wasteload allocation) and nonpoint sources (the load allocation) with a margin of safety.

Ecology has attempted to be clear on the actions required for Drainage District 19 in the TMDL, which are related to future implementation actions that will be considered in addition to their municipal stormwater permit requirements. Other actions needed within the TMDL area where drainage districts are operating are focused on individual landowners, not the districts themselves. Although district responsibilities detailed in RCW Title 85 were mentioned, the comment did not provide additional information on the intersection of landowner responsibilities, district responsibilities, and the TMDL. Ecology has committed to holding additional meetings in early 2021 regarding implementation actions and coordination in the Padilla Bay watershed. We look forward to exploring roles and responsibilities not discussed and detailed in this TMDL thus far.

13 - *Comment:* (Abridged) Given all of the research generally referenced by Ecology, there are only two documented 303(d) listings for fecal coliform. Both sites are in poorly mixed sloughs, are extremely limited in geographic extent, and were listed based on very limited data collected in the 1980s and 1990s and no designated use reported on the 303(d) website.

Throughout the Draft TMDL Report, Ecology links the TMDL for the freshwater tributaries with marine water quality and beneficial uses. Importantly, Ecology has not conducted the

hydrodynamic modeling necessary to evaluate the potential effects of loading from the freshwater tributaries on water quality in the well mixed portions of Padilla Bay. As a result, it is inappropriate and misleading for Ecology to assert that "increase pollutant runoff can decrease water quality, impacting fisheries and closing shellfish beds" in the context of this Draft TMDL Report.

Response: Ecology acknowledges that hydrodynamic modeling would provide additional information related to the pattern and impacts of loading within the marine waters. However, the 303d marine listings are not addressed within this TMDL. Marine reductions and implementation actions included in this TMDL are based on sample results and analysis of the Bay View outfalls. In general, Ecology does believe that reducing upstream sources of pollution will improve conditions in downstream receiving waters.

14 - *Comment:* (Abridged) It is also inappropriate for Ecology to conclude that by "addressing sources of pollution upstream, water quality conditions downstream are expected to improve. These cumulative reductions will be used to guide an adaptive management strategy and implementation activities where efforts will be targeting upstream sources to protect downstream beneficial uses in the freshwater tributaries as they discharge into Padilla Bay."

Response: The language related to discharging into Padilla Bay has been removed to retain focus on the freshwater tributaries. Additional language (repeated below) has been added to the text to clarify the approach.

> "The recommended cumulative reductions for the loading capacities were developed to focus on reducing bacteria sources in upstream areas of each slough. By addressing sources of pollution upstream, the amount of pollutant continuing to be carried downstream is reduced, downstream reductions may also be reduced, and water quality conditions downstream are expected to improve."
>
> "For example, if sample site one (upstream) has a bacteria concentration of 110 cfu/100 ml, and site two (downstream) has a concentration of 165 cfu/100 ml, then a reduction at site one of 75 cfu/100ml may reduce bacteria at both sites one and two to below state standards, since the reduction of 75 cfu/100ml will also reduce total bacteria at site two."

15 - *Comment:* (Abridged) While Ecology accurately describes the importance of the habitat provided to waterfowl, they fail to make the connection between these large populations and a potential natural source of impairment. In addition, the rural nature of the land-use in the area contributing flow to the freshwater tributaries and the presence of agriculture and waterfowl, has been largely unchanged for well over 120 years when this area was diked and drained for agricultural land uses; Ecology does not address this long-term land-use condition in the trend analysis which is the basis of the Draft TMDL Report.

Response: Ecology does consider waterfowl a source of bacteria in the Padilla Bay watershed. Waterfowl in natural numbers in a natural setting generally are not a pollution problem. Where land use changes alter the environment and cause animals to congregate in large numbers that result in an exceedance of water quality standards, BMPs may be needed to control the pollutant. We encourage land owners to track and report when high numbers of waterfowl are present and to work with Ecology and its water cleanup partners to directly assess the potential to pollute and determine BMPs protect surface waters. Most of our observations in other agricultural watersheds reveal waterfowl using cropland, not freshwater surface waters, in their stop overs. Should bacteria be flowing off croplands due to waterfowl, additional filtration through expanded grass filter strips may be needed to control bacteria, sediment, and nutrient pollution.

16 - *Comment*: (Abridged) …the Draft TMDL Report does not reference any of the lessons learned from the Clean Samish Initiative or the data collected by Skagit County and the Washington Department of Agriculture.

Similar comment – Related topic: (Abridged) I have read the Padilla Bay TMDL and I am highly concerned about its scope and processes. The success of what you are trying to achieve is highly unlikely. Your current TMDL plan has not learned from our success and will not experience the same result as the CSI Task Force. It uses the same playbook as the earlier unsuccessful CSI. I suggest you reach out to the participants of the Task Force and reevaluate your approach to the Padilla Bay TMDL.

Response: With the collective approach and cooperation of more than 20 governmental, business and nonprofit organizations, the Clean Samish Initiative is an outstanding example of coordinated data collection and implementation. As stated in previous comments, identifying community supported, and durable solutions helps with implementation efforts. Existing data collection and Pollution Identification Correction efforts ongoing by Skagit County and partners can help guide implementation efforts. Ecology is committed to continue to engage and facilitate discussions in 2021 to support efforts to develop a detailed implementation strategy for the Padilla Bay TMDL area.
Ecology agrees that additional efforts to discuss data collection, analysis methods, and incorporating lessons learned from other programs like CSI can help us achieve our goals.

17 - *Comment:* Skagit County Public Works has had several samples analyzed for both FC and EC over the past few years and the results range from 1:1 to 2:1 and sometimes as high a 10:1. Some measurements suggest that sloughs tend to be 1:1 in the dry season and change to something more like 1.5:1 during the wet season. Based the available data, we question that a regression can reliable predict one from the other (pg 13).

Response: Thank you for this comment and the additional information. The intent of the FC and E. coli comparison is to support the use of FC data in consideration with the updated *E. Coli*

bacterial indicator and is not meant to be used as a FC/*E. coli* translator value. We revised this language in the report so this is clearer.

18 - *Comment:* Much of the stormwater infrastructure within the Bayview Ridge/Golf Course/ Frazier Heights is owned, maintained by Skagit County, so IDDE Screening and Response will be addressed by the County in much of this area rather than by DD19.

Response: During the development of the TMDL, the MS4 boundaries and infrastructure identified within the report area were reviewed to develop WLA values. Skagit County provided detailed geospatial information within the TMDL area, and the areas described within the MS4 and Secondary MS4 permit language were compared to the mapped boundaries recently provided to Ecology (where available). The WLA values were based on best available information at the time of the TMDL development.

Through this effort, it was determined that the areas addressed by MS4 permittees may overlap, with multiple permittees identifying an area to be within their MS4 boundary. Ecology will continue to work with MS4 permittees to help clarify the MS4 permit boundaries, as well as work to ensure better understanding and compliance with all permit requirements.

19 - *Comment:* The tone of the report is that agriculture is the primary land use concern since that makes up the majority of the land use in the watershed. We know from our work that everyone contributes (industry, residential, roads, etc). A significantly more focused sampling effort would be needed to point to a primary pollution source.

Response: The source analysis within each of the slough watershed sections in Chapter 3 briefly describes potential sources specific to the reaches in each sub watershed. While agricultural land uses are described as potential sources in Joe Leary and No Name Slough, additional sources include septic systems, pet waste, and wildlife. Little Indian Slough highlights commercial and industrial stormwater runoff, as well as potential Klebsiella bacteria issues. Big Indian Slough highlights potential septic systems issues as well as stormwater runoff, as well as potential agricultural sources.

The descriptions of potential sources are based on the sample results and land uses adjacent to the highest loading areas. Ecology also acknowledges that additional sampling could help refine implementation efforts, and we support local efforts to continue to collect data and enhance understanding of water quality issues within the TMDL area.

20 - *Comment:* Skagit County is concerned about ECY's effort to rush approval of the document though the review and public comment period. Is this in order to approve it before the State switches to E. coli as the standard?

Response: While the surface water standards are changing to *E. Coli*, Fecal Coliform Bacteria standards are still applicable to marine waters with designated uses of Shellfish harvesting. Ecology acknowledges that submitting this TMDL to EPA before fully switching to the new

recreational contact criteria is one factor used in timing the completion of this TMDL. Another very important factor was the high priority work in the Lower Skagit River Tributaries that caused us to reprioritize our Skagit water cleanup resources in 2019. Although we are switching to *E. coli* as our new freshwater indicator organism, we do believe that fecal coliform is a good indicator species and the technical work done by Ecology and its partners during the study should be fully utilized. Delaying the submission to EPA works contrary to that determination.

Based on the public participation requirements described within the CWA, this TMDL has met all obligations through virtual public meetings, and making the report available for the 30-day public comment period. Due to multiple TMDLs being reviewed simultaneously at the state and regional level, the Padilla Bay Freshwater Tributaries TMDL internal review process was slowed, and the TMDL advisory group period was condensed. Our review of comments submitted during the public comment period did not reveal any technical flaws in our field work or analysis. However, we have received a comment that more local discussion and coordination on implementation could add further value to our efforts to implement the TMDL. For that reason, Ecology is committing to continuing discussions with local partners and stakeholders in 2021 to improve TMDL implementation strategies. We also commit to creating an addendum to the approved TMDL if needed.

21 **-** *Comment:* If the SCD Stream Team data was not used to assess conditions in the study area, why is their data referenced in the report?

Response: Participants within the Stream Team had reached out to Ecology and requested that we briefly discuss the data collection effort. While the data was not used in the report due to differences in collection and analysis methods, it was requested that we acknowledge the ongoing effort, as well as how the data may be used in the future to refine implementation efforts.

22 **-** *Comment:* The claim that using the 100 cfu geomean parameter is more conservative and appropriate for an MOS than is the 90% parameter is confusing. By far, more sites fail the 90% parameter. That is true in other TMDLs and is also claimed in this TMDL. Many sites pass the 100 cfu geomean and fail the 90% parameter. This would be opposite of an MOS.

Response: Ecology used the more conservative bacteria concentration value (100 cfu vs 200 cfu) for the TMDL calculations. While most sites did not meet the 10 percent statistical test value (200 cfu/100 mL), by having the loading capacity and allocations use the lower bacteria value (100 cfu/100 mL), the sites are expected to meet both water quality criteria.

23 - *Comment:* The “Eastern Padilla Bay Tributaries Fecal Coliform Bacteria Total Maximum Daily Load Study: Water Quality Study Findings” published in February 2020 was not shared or reviewed by the Technical group.

Response: Ecology acknowledges Skagit County as a key stakeholder and that the formal document entitled "Eastern Padilla Bay Tributaries Fecal Coliform Bacteria Total Maximum Daily Load Study: Water Quality Findings" was not provided for review and comment to the Technical Group. The design of the study was originally made available to stakeholders in the Eastern Padilla Bay Tributaries Fecal Coliform Bacteria Total Maximum Daily Load Quality Assurance Project Plan[27] in April 2016. In order to avoid redundant meetings on identical technical findings, Ecology chose to review the draft TMDL report as opposed to the Water Quality Study Findings report during Technical/Advisory Group meetings.

24 - *Comment:* Would there be value in having a historical perspective on the effect of waterfowl / wildlife on the fecal coliform levels?

Response: Several informal discussions through the course of our study suggested that waterfowl levels have varied over time and may have increased. Ecology believes that direct coordination with landowners experiencing or observing high waterfowl/wildlife on their lands will lead us most quickly to solutions for both landowners and public surface water resources. In the Samish Bay Fecal Coliform TMDL, Ecology compared the seasonal residency of waterfowl with bacteria concentrations and did not see a consistent pattern. The following is an excerpt from that TMDL.

> "Various species of non-migratory birds were present throughout the Samish watershed at all times of year. Migratory birds, such as ducks and geese, were abundant in fall and early winter when they grazed in fields and temporary puddles and pools. Bird numbers and species changed from location to location, day to day, and year to year, making them nearly impossible to count accurately or to correlate with bacteria concentrations. However, the TMDL data suggest birds did not cause exceedances of fecal coliform criteria in the lower Samish River, because concentrations in the river generally decreased from river mile 10.3 to 0.7 near the mouth, where the greatest numbers of birds were noted. Bacteria load in the river also tended to stay fairly constant downstream of river mile 10.3, suggesting that no significant new sources were adding to the load below 10.3.
>
> Since waterfowl in the Samish basin were more abundant in November through March, it could be expected that the critical period (the time of highest bacteria counts) would match this period of the year, if waterfowl fecal contributions were a significant part of the bacteria load.

[27] https://fortress.wa.gov/ecy/publications/documents/1603105.pdf

However, review of the biweekly monitoring data for Samish River and tributaries and Samish Bay discharges (Table C-1 in Ecology 2008a) shows that only one of the monitoring sites (WED-GATE, the West Edison tidegate) has higher bacteria counts in November through late winter than at other times of year. All the other monitoring sites that discharge directly to Samish Bay, and that are in the lower flats of the watershed where overwintering geese and swans congregate, have higher bacteria concentrations in the April through September period.

If natural levels of fecal coliform bacteria (from birds and other wildlife) do cause criteria to be exceeded, no allowance exists for human sources to measurably increase bacteria pollution further. Since human-caused bacteria pollution is evident in the watershed, the target reductions for bacteria are considered appropriate."

25 - *Comment:* Second, are there any current engineering solutions that could be implemented in the respective hot spots noted on your water flow map?

Response: At this time, Ecology believes that an evaluation of best management practices in place where hot spots exist is the best first course of action. We have not evaluated any specific engineering solutions (e.g., regional treatment, coordinated manure management) but hope to share any ideas we have in the future and discuss local ideas in more detail.

26 - *Comment:* Our concern is those agricultural areas will be held to a higher standard on water quality than waters originating from upstream areas. This has the potential to allow poor water quality waters to flow into agricultural areas, thus relying on farmers to clean up water that did not originate on their farm. This potentially could put undue hardship on farmers who already comply with the directives required for water quality on their operation.

Response: Ecology acknowledges that water quality issues can start upstream of farm operations. Examples include municipal stormwater, industrial stormwater, onsite septic system failures, and in some cases concentrated wildlife numbers. Ecology appreciates the work of the local agricultural community to protect and enhance water quality. The water quality standards applied throughout the TMDL area are consistent across all tributaries and land uses.

27 - *Comment:* The TMDL also points out wild waterfowl as an issue with Fecal Coliform in the waters. Skagit County is in a major waterfowl migratory area with thousands birds flying passing through and resting in the areas bays, rivers, ditches and agricultural fields. The birds leave their impact on each of these areas every time they frequent the area. The agricultural community has no control over the actions of wild animals or the footprint they leave behind. Analyzing farms for the impacts of migratory birds and wildlife is of little value.

Response: Ecology disagrees that analyzing farms for impacts of migratory birds is of little value, as additional information collected in and around areas where wildlife congregate can help

establish conditions and determine what natural loading levels may be. We encourage landowners to work with local sampling efforts to report when there is a high occurrence of migratory birds on their lands and in their local waterways.

We would like to acknowledge when birds may be directly contributing bacteria through their presence in the water. Nearly all observations made to date indicate that waterfowl are using land, rather than water, in their migration stop overs. Where waterfowl presence on the land is leading to excessive bacteria levels in the water, best management practices to control runoff of bacteria, sediment, and nutrients may be needed.

28- *Comment:* The TMDL also points to recreational use as an important factor for water quality. Skagit County drainage is managed by local drainage and irrigation districts. These waters flow predominantly through private property therefore provide no access for recreational use. As these waters are not available for primary contact recreation, this standard would not apply to them.

Response: In many state waters where the general public does not have direct access, the Washington State Water Quality Standards still apply. Although general public access may not be permitted, local residents should be able to use the waters in the Padilla Bay for recreational purposes if desired.

See the response to comment 12 for additional information.

29 - *Comment:* The Agricultural Advisory Board agrees water standards are important in Skagit County and local farms make every effort to maintain good water quality for all. The AAB wants to ensure these efforts do not go unnoticed by the Department of Ecology. We ask you acknowledge water quality issues that start upstream of farm operations and by wildlife are outside of the respective farmer's control.

Response: Ecology acknowledges that water quality issues can start upstream of farm operations. Examples include municipal stormwater, industrial stormwater, onsite septic system failures, and in some cases concentrated wildlife numbers. Ecology appreciates the work of the local agricultural community to protect and enhance water quality.

30 - *Comment:* The Ecology TMDL reports inappropriately point the finger at dairy farms while ignoring or minimizing other known and significant contributors to bacteria. We are very concerned that the apparent bias of those drafting the report has minimized other sources of contamination in order to support their position of dairy contributions.

Response: Ecology understands that the dairies in the Padilla Bay watershed have a good compliance record under the WSDA Nutrient Management Program. Dairies are not singled out in the plan as the most important source but rather as one of a number of potential sources.

Ecology also acknowledges the previous and ongoing efforts of dairies to implement practices and reduce bacterial pollution. While language related to dairy lagoons is included within the prescriptive guidance under manure management, the section is also intended to guide all livestock waste management, including general grazing and pasture operations and recreational animals such as horses.

The TMDL document does not describe point source pollution control practices in as much detail as nonpoint source pollution control practices because the point source permits themselves contain the detailed requirements.

31 - *Comment:* The role of wildlife is downplayed even though there is strong evidence that wildlife play a very significant role in bacteria contamination. This is documented by the EPA DNA study that showed a lack of cattle markers in the Nooksack river drainage but with significant avian and other ruminant markers. Padilla Bay hosts hundreds of thousands of wintering waterfowl and these leave their fecal matter on saturated fields with ready access to the numerous drainage channels. Dairy cattle are strictly prohibited from proximity to these drainages and most cattle in this drainage are contained in shelter facilities that allow for complete collection and management of the animal nutrients.

Response: In undisturbed watersheds, wildlife plays a minor role in bacteria loading. However, land use changes can have a major effect on the contribution of pollutants from wildlife. Ecology recognizes that genetic markers may have a role in identifying sources of bacteria when incorporated into a proper study design. The applicability and overall usefulness of individual markers vary and should be closely considered at the outset of a study. Although genetic markers can be useful for identifying the presence of certain species, this source identification tool cannot be used to explicitly discern the relative contribution of bacteria from different animal species. Ecology also acknowledges the work of the dairy industry to protect water quality through the Dairy Nutrient Management Act and the Combined Animal Feeding Operation (CAFO) permit.

32 - *Comment*: The impact of other farm and non-farm animals is downplayed despite the fact that only dairy cattle are subject to the nutrient management requirements that have proven to be protective of water quality.

Response: Ecology does not intend to downplay the potential impact of bacteria sources other than dairy cattle. We acknowledge that bacteria from pet waste as well as from improperly stored or utilized manure from any animal can contribute to local pollution problems.

33 - *Comment*: Klebsiella is a well-known significant contributor to bacteria contamination, yet the potentially large sources of klebsiella contamination are not included in the Padilla Bay report. Berry farms will routinely use large quantities of sawdust as a mulch around berry plants

and the drainage is home to significant acreage of blueberries. A large wood products industrial facility is also included in the drainage without any reference as a potential contributor.

Response: Klebsiella is identified as a potential source of pollution in the source analysis section of Little Indian Slough, page 47. In cases where Klebsiella may have contributed to large fecal coliform counts, Ecology recommends the use of E. coli testing when conducting source identification work. Klebseilla do not grow on the media used for E. coli tests.

34 - *Comment:* Farmers have frequently communicated that without DNA microbial source testing, there is no certain way of ascertaining the sources of bacterial contamination. Farmers earnestly seek the facts about contamination and should farm operations be found responsible are fully in support of making the necessary changes.

Response: Ecology sees microbial source tracking using genetic markers as a potential tool in certain situations, especially when narrowing source possibilities close to a human septic source. We will continue to track the development of this tool and look to use it where appropriate.

The lack of well-established, widely-accepted best management practices on a farm continues to be our key tool for identifying potential pollution discharges from those land uses. In areas with more urban land uses, data-driven source tracing is a commonly used tool to find and fix pollution sources. We look forward to continued conversation and work with the farming community on the most useful tools and approaches for identifying and confirming potential bacteria pollution sources.

35 - *Comment:* In the early 2000's, WWAA and twelve Skagit dike and drainage districts, worked with state and federal agencies to develop a landscape-wide infrastructure program, to balance agricultural drainage management with aquatic resource protection. The Skagit County Drainage and Fish Initiative (DFI) reinforces each districts responsibility and authority to maintain infrastructure in accordance with applicable laws and regulations. The three districts managing the Report tributaries receive programmatic local, state, and federal environmental and regulatory review and permitting within the DFI.

The DFI provides a thoroughly vetted watercourse inventory that could complement and inform WDOE's work to maintain the State's water quality. The delineation and classification of watercourses within the DFI was studied and informed by landscape change and history review, district authorities and responsibilities, in-water resource impacts and regulations, existing landscape conditions and features, and community priorities for the watershed(s) and delta(s). However, WDOE failed to incorporate and utilize this information to assess the watercourses and characterize the watershed. Consequently, the Report proposes water quality improvement actions in district managed watercourses, inconsistent with how they are

regulated and managed in the DFI. As such, the Report does not recognize district infrastructure and agricultural landscape as a baseline or desired condition.

Response: Please refer to Comment and Response #12 for information about the application of water quality standards to waters of the state, including the watercourses described within the Skagit Delta Tidegates and Fish Initiative (2010) document. The DFI agreements establish fish habitat mitigation goals and control of turbidity during in-water agricultural maintenance activities and related to CWA 401 and 404 regulations. In contrast to the DFI's in-water action and mitigation focus, the function of a TMDL is to address discharges to surface waters from upland activities.

We acknowledge the valuable work by NOAA, WDFW, Ecology's Shorelines and Environmental Assistance (SEA) Program, Western Washington Agriculture, and the many Skagit drainage districts to balance the need for agricultural maintenance with restoration of fish habitat while complying with state requirements to control turbidity related to in-water work. Ecology looks forward to continued dialogue on the intersection of the DFI and state goals to meet state recreational bacteria standards.

The "Skagit Delta Tidegates and Fish Initiative Implementation Agreement" document states on page 3-7,

> "Please note that under the CWA, additional separate actions may be needed to protect or improve water quality. For example, if a stream reach of slough is listed under section 303(d) of the CWA, a water cleanup plan may be required in the future."

As noted earlier in the response to comments, Ecology is committing to continued discussion and refinement of implementation strategies in 2021. Should additions or changes be needed in the TMDL as a result of those discussions, Ecology will prepare an addendum to the approved TMDL.

36 - *Comment:* WWAA does not believe the Report accurately characterizes current watershed conditions or identify water pollution inputs, and fails to establish the relationship between land use inventories and water samples taken. As agricultural producers, and dairy operations specifically, receive attention with respect to the "potential to pollute", fecal coliform levels appear to progressively decrease in watercourses when adjacent to and flowing through farmlands. WWAA understands that ongoing Skagit County ambient water quality monitoring programs report stable water quality conditions over time in the Padilla Bay watershed's agricultural landscape. As such, recommended agricultural best management practices within the Report seemingly do not correlate to or account for either background or increased fecal coliform in the watercourses.

Response: Ecology believes that our study design and consideration of other data sources during the time period evaluated are accurate and representative of conditions at that time.

We are not aware of newer data that contradicts our findings. As new data becomes available, we concur that it should be considered in relationship to seasonal and meteorological conditions and used to guide/prioritize water cleanup efforts. When newer data shows consistent compliance with state standards, those areas should receive a low priority for water cleanup actions. Although our study did establish a relationship between land use and the concentration of bacteria levels related to stormwater dischargers, its most valuable contribution in describing watershed conditions was based on direct monitoring of water quality and waterbody flows, not the establishing a relationship between land use and the potential to pollute.

The characterization of the watershed is based on the TMDL sampling results which are used to calculate the loading and reduction values necessary to satisfy the TMDL requirements. The reduction targets for each watershed (figure 13 through 19) are based on the calculated loading within the sampled reach. Based on the cascading reduction approach used within the TMDL, each of the downstream values reflected the upstream reductions. The actual loading values for each reach and sub watershed are included in Appendix E, which do reflect a consistent increase of bacteria moving from upstream to downstream. Skagit County's excellent water quality data collection and data/trends analysis, coupled with targeted source tracing data collection, is essential to continue to refine the understanding of the watershed and identify the most appropriate places for implementation activities. While trend data is excellent for understanding the long term conditions of the watershed, as long as water quality standards are exceeded, additional actions may be necessary to improve water quality.

37 - *Comment:* (Abridged) … broad stakeholder expertise and existing program inclusion into WDOE's improvement and implementation plans such as this Report would insure that consistent actions are taken to resolve natural resource management issues and mandates in Skagit area watersheds. Skagit County Public Works' robust drainage utility and natural resources programs, including the *Clean Samish Initiative* and *Voluntary Stewardship Program,* offer pathways for comprehensive and cooperative participation. In addition, Skagit County's 1995 Padilla Bay/Bay View Watershed Nonpoint Action Plan offers additional insight and direction on engaging and assessing the greater agricultural community into WDOE mandates and goals.

Response: Ecology supports ongoing discussion and coordination to ensure consistent actions are taken to resolve natural resource management issues and mandates in Skagit area watersheds. We are committed to working with local stakeholders to build durable implementation strategies that are, where appropriate, modeled after local program successes and earlier nonpoint action plan findings.

We agree that Skagit County Public Works' robust drainage utility and natural resources programs, including the Clean Samish Initiative and Voluntary Stewardship Program, are pathways for comprehensive and cooperative participation. In our continued discussions planned for 2021, we look forward to reviewing the 1995 Padilla Bay/Bay View Watershed

Nonpoint Action Plan for additional insight and direction on identifying ways to work with the Skagit Watershed's agricultural community.

38 - *Comment:* WWAA requests WDOE to reinitiate the data synthesis and community engagement elements of the Padilla Bay Freshwater Tributaries Fecal Coliform Bacteria Total Maximum Daily Load Report- Water Quality Improvement Report and Implementation Plan. WWAA realizes this does not align with current WDOE and EPA timelines. However, broad stakeholder involvement and comprehensive data sets are critical to correctly defining and improving landscape conditions. WWAA finds the described omissions to be of critical importance to the Report's purpose and validity, and respectfully requests delayed Report submittal to the EPA.

Response: As stated in previous comments, identifying durable, community supported solutions will help with successful implementation. Ecology is committed to continue to engage and facilitate discussions in 2021 to improve implementation strategies in the Padilla Bay watershed TMDL area.

While Ecology believes that the data collection, analysis, and reductions values accurately characterize the conditions of the watershed to satisfy the TMDL requirements, Ecology also recognizes the necessity in continuing to integrate the most current information and refine implementation efforts as part of adaptive management of the TMDL. Ongoing water quality data collection efforts are essential to finding and fixing discrete pollution sources and are a necessary part of any durable implementation strategy. And data/trends analysis is essential for tracking watershed health, bracketing areas of concern for focused implementation activityies, and documenting community success towards improved water quality.

Ecology's review of comments submitted during the public comment period did not reveal any technical flaws in our field work or analysis. However, we have received multiple comments that more discussion and coordination on implementation could add further value to the TMDL. Based on the outcomes of continued discussion and coordination with local stakeholders, we may develop an addendum to the approved TMDL if significant changes to the TMDL are warranted.

39 - *Comment:* Broadly, Washington Department of Agriculture’s Dairy Nutrient Management Program (DNMP) recognizes that the TMDL draft sections on pages 60-65 reference “guidance”, however, many of the recommendations use absolute language, such as “must” and “required”, while other recommendations use “should” and “may”. This language is combined with NRCS practice standard references that may not apply to licensed dairies and permitted CAFOS. This is confusing to regulator and the regulated.

Recommendation: WSDA recommends removing absolute language in BMP guidance unless a specific rule or regulation is sited and clarifying when NRCS practice standards are applicable.

Response: A TMDL alone is not legally enforceable. We use the terms "needed" or "required" to generally indicate that such actions are important to achieving water quality standards.

This TMDL acknowledges that Washington State dairies are regulated by the Dairy Nutrient Management Act and/or the Combined Animal Feeding Operation (CAFO) permit. The requirements associated with those regulations must be followed and are enforceable. When those NRCS practices are less protective than what is described in this TMDL, Ecology encourages WSDA and dairy owners to adopt the more protective management practices.

40 - *Comment:* On page 61, the TMDL draft recommends that dry and wet manure storage be set back 100 feet from surface water. However, NRCS Waste Storage Facility standards (Code 313) guidelines do not specify distance from surface water for siting manure storage facilities.

Response: We acknowledge that NRCS standards do not require the setback. The 100' set back is an Ecology recommendation to be fully protective of water quality.

41 - *Comment:* This section (page 61-62) also addresses lagoons, stating that they should be designed for "...an extra 4 months of liquid manure production as no manure application is allowed during winter (November 1 through February 1)." WSDA does not prohibit manure applications at any time of year, as long as the applicator demonstrates an agronomic need and the application is protective of surface water. The TMDL draft statement prohibiting three months of winter application (November 1-February 1) also contradicts the limitation for permitted CAFOs (Oct 1 to TSUM 200).

Recommendation: WSDA recommends replacing "…no manure application is allowed…" with "…manure applications may at be high risk of runoff…".

Recommendation: WSDA recommends adding a caveat about NRCS standards if they are going to be referenced in the draft, such as "NRCS practice standards provide guidance to a variety of livestock operations and field practices, but do not apply to all operations and practices. If existing regulations and requirements do not apply, manure and livestock nutrients should be stored in systems and structures that meet [current] NRCS standards.

Response: The TMDL now uses the language, "All liquid manure should be utilized in a manner that prevents contamination of State waters". We have also removed rate and timing information, and made the language more consistent with other TMDLs across the state. NRCS practice standard language has been added to the TMDL language as recommended.

42 - *Comment:* On page 69, the Waterfowl and Other Wildlife section is confusing. Skagit County dairy producers frequently point to the presence of waterfowl on their that may impact water quality. This section notes that "Ecology does not consider fecal coliform loadings from warm-blooded animals in natural numbers to be a pollution source." Additionally, "…human activities can lead to high animal densities that contribute excessive amounts of bacteria to local waters." While it's unclear what a "natural number" of water fowl is, vs a "high animal density", it is clear that some landowners are paid by our sister agencies to leave forage and provide habitat for waterfowl and other wildlife. How does Ecology intend to determine whether fecal coliform pollution is the result of natural numbers of waterfowl and wildlife, vs pollution caused by human activity leading to high animal densities?

Response: Ecology recognizes that there have been significant and widespread changes to land uses in many areas of Puget Sound. It may not be possible to accurately discern between natural bird numbers and higher waterfowl densities that result from past and current activities. Landscape changes in other locations within waterfowl migratory ranges might also be a factor. In areas where forage is left for wildlife, best management practices should be implemented to reduce overland flow, increase infiltration, and reduce bacterial pollution.

43 - *Comment:* The Wet manure storage guidance section on page 62 states that "Clean water must be diverted from entering manure storage lagoons…" The intent may be to state that lagoons should not unnecessarily collect clean water, however there are no requirements to put a roof over lagoons, and no prohibition from adding clean water to lagoons. Many dairies specifically route clean water to their lagoons in the summer to make sure the manure is thin enough to pump.

Recommendation: WSDA recommends replacing the word "must" with "may need to".

Response: The TMDL language has been updated as follows: "Clean water should be diverted from entering manure storage lagoons through the use of gutters, berms, roofs, or other means of conveyance to avoid unnecessary storage of clean water as well as prevent contact of stormwater with manure in production areas."

44 - *Comment:* On page 59 in the Livestock Management section, the third and fourth paragraphs accurately describe WSDA's regulatory authority over licensed cow dairies and the collaborative relationship with Ecology. On page 73, Washington State Department of Agriculture section, points of WSDA's authority are misstated. Please see below for recommended changes.

Response: The recommended changes have been incorporated in the text of the TMDL on page 73.

Appendix C: Glossary, Acronyms, and Abbreviations

303(d) List: Section 303(d) of the federal Clean Water Act requires Washington State periodically to prepare a list of all surface waters in the state for which beneficial uses of the water – such as for drinking, recreation, aquatic habitat, and industrial use – are impaired by pollutants. These are water quality-limited water bodies (ocean waters, estuaries, lakes, and streams) that fall short of state surface water quality standards and are not expected to improve within the next two years.

Analyte: Water quality constituent being measured (parameter).

Best Management Practices (BMPs): Physical, structural, or operational practices that, when used singularly or in combination, prevent or reduce pollutant discharges.

Clean Water Act: A federal act passed in 1972 that contains provisions to restore and maintain the quality of the nation's waters. Section 303(d) of the Clean Water Act establishes the TMDL program.

Critical condition: When the physical, chemical, and biological characteristics of the receiving water environment interact with the effluent to produce the greatest potential adverse impact on aquatic biota and existing or designated water uses. For steady-state discharges to riverine systems, the critical condition may be assumed to be equal to the 7Q10 (see definition) flow event unless determined otherwise by the department.

Designated uses: Those uses specified in Chapter 173-201A WAC (Water Quality Standards for Surface Waters of the State of Washington) for each water body or segment, regardless of whether or not the uses are currently attained.

Exceeded criteria: Did not meet criteria.

Load allocation: The portion of a receiving water's loading capacity attributed to one or more of its existing or future sources of nonpoint pollution or to natural background sources.

Loading capacity: The greatest amount of a substance that a water body can receive and still meet water quality standards.

Margin of safety: Required component of TMDLs that accounts for uncertainty about the relationship between pollutant loads and quality of the receiving water body.

Municipal separate storm sewer systems (MS4): A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains): (1) owned or operated by a state, city, town, borough, county, parish, district, association, or other public body having jurisdiction over disposal of wastes, stormwater, or other wastes and (2) designed or used for collecting or conveying

stormwater; (3) which is not a combined sewer; and (4) which is not part of a Publicly Owned Treatment Works (POTW) as defined in the Code of Federal Regulations at 40 CFR 122.2.

National Pollutant Discharge Elimination System (NPDES): National program for issuing and revising permits, as well as imposing and enforcing pretreatment requirements, under the Clean Water Act. The NPDES permit program regulates discharges from wastewater treatment plants, large factories, and other facilities that use, process, and discharge water back into lakes, streams, rivers, bays, and oceans.

Natural conditions: Surface water quality that was present before any human-caused pollution. Also called "natural background levels."

Nonpoint source: Pollution that enters any waters of the state from any dispersed land-based or water-based activities, including but not limited to, atmospheric deposition; surface water runoff from agricultural lands; urban areas; or forest lands; subsurface or underground sources; or discharges from boats or marine vessels not otherwise regulated under the National Pollutant Discharge Elimination System Program. Generally, any unconfined and diffuse source of contamination. Legally, any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act.

Parameter: Water quality constituent being measured (analyte). A physical, chemical, or biological property whose values determine environmental characteristics or behavior.

Point source: Sources of pollution that discharge at a specific location from pipes, outfalls, and conveyance channels to a surface water. Examples of point source discharges include municipal wastewater treatment plants, municipal stormwater systems, industrial waste treatment facilities, and construction sites that clear more than five acres of land.

Pollution: Such contamination, or other alteration of the physical, chemical, or biological properties, of any waters of the state. This includes change in temperature, taste, color, turbidity, or odor of the waters. It also includes discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state. This definition assumes that these changes will, or are likely to, create a nuisance or render such waters harmful, detrimental, or injurious to (1) public health, safety, or welfare, or (2) domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or (3) livestock, wild animals, birds, fish, or other aquatic life.

Reach: A specific portion or segment of a stream.

Riparian: Relating to the banks along a natural course of water.

Salmonid: Any fish that belong to the family Salmonidae. Any species of salmon, trout, or char.

Stormwater: The portion of precipitation that does not naturally percolate into the ground or evaporate but instead runs off roads, pavement, and roofs during rainfall or snow melt.

Stormwater can also come from hard or saturated grass surfaces, such as lawns, pastures, and playfields, and from gravel roads and parking lots.

Surface waters of the state: Lakes, rivers, ponds, streams, inland waters, salt waters, wetlands and all other surface waters and water courses within the jurisdiction of Washington State.

Surrogate measures: To provide more meaningful and measurable pollutant loading targets, EPA regulations [40 CFR 130.2(i)] allow other appropriate measures, or surrogate measures in a TMDL. The Report of the Federal Advisory Committee on the Total Maximum Daily Load (TMDL) Program (EPA, 2001a) includes the following guidance on the use of surrogate measures for TMDL development:

> *When the impairment is tied to a pollutant for which a numeric criterion is not possible, or where the Impairment is identified but cannot be attributed to a single traditional "pollutant," the state should try to identify another (surrogate) environmental indicator that can be used to develop a quantified TMDL, using numeric analytical techniques where they are available, and best professional judgment (BPJ) where they are not.*

Total Maximum Daily Load (TMDL): A distribution of a substance in a water body designed to protect it from exceeding water quality standards. A TMDL is equal to the sum of all of the following: (1) individual wasteload allocations for point sources, (2) the load allocations for nonpoint sources, (3) the contribution of natural sources, and (4) a Margin of Safety to allow for uncertainty in the wasteload determination. A reserve for future growth is also generally provided.

Turbidity: A measure of water clarity. High levels of turbidity can have a negative impact on aquatic life.

Wasteload allocation: The portion of a receiving water's loading capacity allocated to existing or future point sources of pollution. Wasteload allocations constitute one type of water quality-based effluent limitation.

Watershed: A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

90th percentile: A statistical number obtained from a distribution of a data set, above which 10 percent of the data exists and below which 90 percent of the data exists.

Appendix D: Analytical Framework

The Eastern Padilla Bay Tributaries Fecal Coliform Bacteria Total Maximum Daily Load Study: Water Quality Study Findings (McCarthy, 2020) provides the technical analysis for this study. The technical report includes field and analytical method descriptions, a comprehensive assessment of data, analysis of FC concentrations and loads throughout the study area, and recommendations for a TMDL strategy for loading capacity, LAs, and WLAs. The following sections provide a summary of the analytical framework for this study. Additional information can be found in the technical report.

Analytical Approach

For the Padilla Bay Tributaries TMDL, FC data were collected at a fixed network of routine sampling sites throughout the eastern Padilla Bay watershed along Joe Leary Slough, Big Indian Slough, Little Indian Slough, and No Name Slough, in addition to a subset of outfalls throughout the town of Bay View. Figure D. 1 shows the location of the fixed-network FC sampling sites. Each of these sites was sampled more than five times throughout the field collection duration. Additional sites were added to further pinpoint potential pollutant sources as investigative sites. Although these investigative sites were not used as part of the technical analysis component of this project, they are useful to help identify potential sources of FC. More details about each specific sampling location can be found in the technical report.

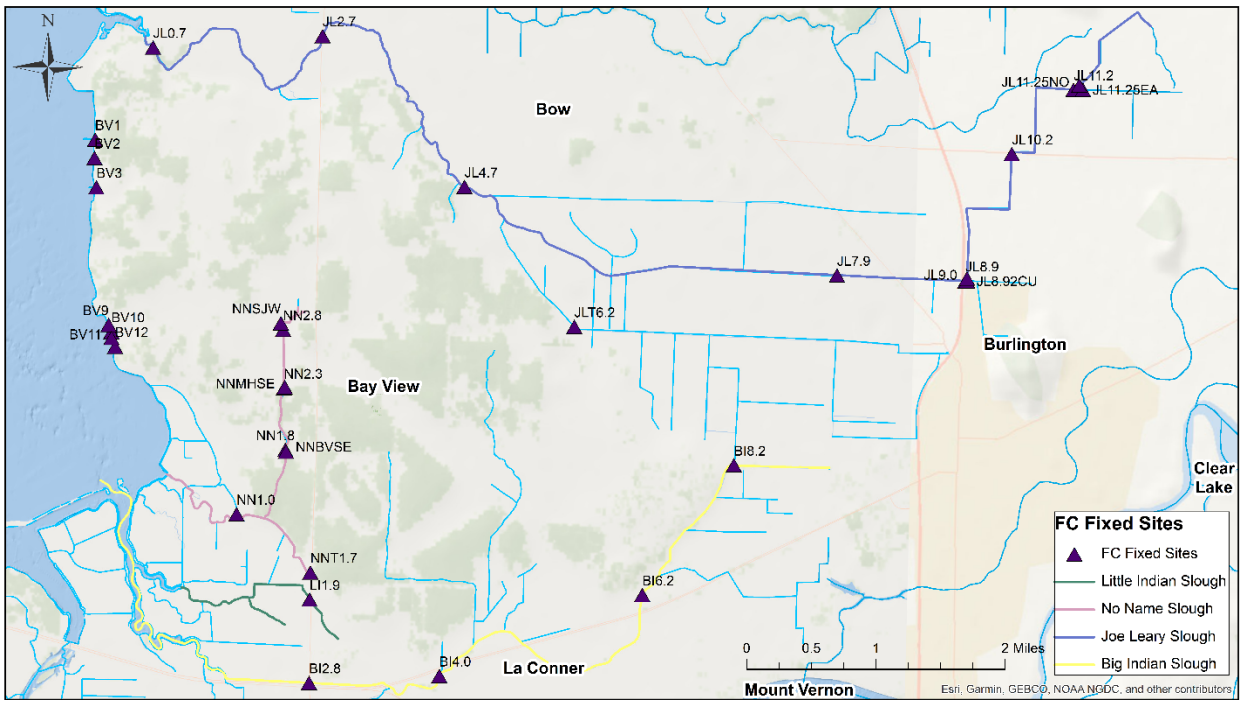


Figure D. 1 - Map of fecal coliform sampling sites.

Data Collection

This study followed the procedures and protocols outlined in the QAPP (Fields, 2016). Grab samples of FC were collected at a fixed network of sites throughout the Padilla Bay watershed from 2016-17. Some sites were only able to be sampled intermittently, due to low flow levels. Flow measurements were taken along with FC samples at select sites throughout both wet and dry seasons during the sampling period. For the site near the tide gate on Joe Leary Slough (JL0.7), flow measurements were taken during low tide, when the tide gate was open.
The project QAPP (Fields, 2016) stated the possibility of further investigation work of FC bacteria concentrations using optical brightener surveys. However, due to limits on staff resources and scheduling constraints, this field sampling method was not used.

Shoreline surveys are based on results from the Bay View outfall sites, and a discussion of these results is in Chapter 3.

Bacteria samples were analyzed by Manchester Environmental Laboratory (MEL) according to standard methods outlined in the QAPP (Fields, 2016).

A summary of the fixed and intermittent sites, along with the number of flow measurements and FC samples is in the Eastern Padilla Bay Tributaries Fecal Coliform Bacteria Total Maximum Daily Load Study: Water Quality Study Findings[28] (McCarthy, 2020).

Data Quality

The QAPP developed for this study describes the procedures used to collect and analyze field measurements and water quality samples (Fields, 2016). Ecology assessed all data used in this report for quality.
See the "Eastern Padilla Bay Tributaries Fecal Coliform Bacteria Total Maximum Daily Load Study: Water Quality Study Findings[29]" (McCarthy, 2020) for more information about the data quality assessment.

Statistical Rollback Analysis

The statistical rollback method (Ott, 1995) is used to calculate bacteria reduction targets for stream segments. The rollback method compares monitoring data to standards, and the difference is the percentage change needed to meet the standards.

The rollback method has been applied by Ecology in many other bacteria water quality exceedance studies (Coots, 2002; Fields, 2016; Joy, 2006; Joy and Swanson, 2005; Mathieu and James, 2011; McCarthy, 2018; Pelletier and Seiders, 2000; Swanson, 2009).

[28] https://fortress.wa.gov/ecy/publications/documents/2003001.pdf
[29] https://fortress.wa.gov/ecy/publications/documents/2003001.pdf

Ideally, at least 20 samples taken throughout the year are needed from a broad range of hydrologic conditions to determine an annual bacteria distribution. If bacteria sources vary significantly by season and create distinct critical seasons, seasonal targets may be required. Fewer data provide less confidence in bacteria reduction targets, but the rollback method is robust enough to provide pollutant allocations and targets for planning implementation measures using smaller data sets. Compliance with the most restrictive of the dual bacteria standard criteria determines the bacteria reduction needed at a stream sampling site. The rollback method is applied as follows:

> *The geometric mean (approximate median in a log-normal distribution) and 90th percentile statistics are calculated and compared to the water quality bacteria criteria. If one or both do not meet the criteria, the whole distribution is "rolled-back" to match the more restrictive of the two criteria. The 90th percentile criterion is usually the most restrictive.*

The rolled-back geometric mean or 90th percentile bacteria value then becomes the recommended *target* bacteria value for the site. The term **target** is used to distinguish these estimated numbers from the actual water quality criteria. The degree to which the distribution of bacteria counts is **rolled-back** to the target value represents the estimated percent of bacteria reduction required to meet the bacteria water quality criteria and standards.

The bacteria targets are only in place to assist water quality managers in assessing the progress toward compliance with the bacteria water quality criteria. Compliance is ultimately measured as meeting both parts of the water quality standards criteria. Any water body with bacteria targets is expected to:

- Meet both the applicable geometric mean and "percent exceedance" criteria.
- Protect designated uses for the category.

The rollback method assumes that the distribution of the data follows a log-normal distribution. FC concentrations from each of the sites were tested for log-normality prior to the use of the roll-back method. In all instances, the data sets met the log-normality test. Sites that were not log-normally distributed were not used as part of the statistical roll-back analysis. The cumulative probability plot of the observed FC data gives an estimate of the geometric mean and 90th percentile which can then be compared to the FC concentration standards.

Establishing Critical Seasons

Seasonal variations were determined based on historical precipitation records and were compared with rainfall data from the 2016-17 sampling period. Based on historical precipitation averages, the wet season is defined as October-April and the dry season is from May-September (Fields, 2016). Daily precipitation data from 2016-17 were obtained from the National Estuarine Research Reserve System in Padilla Bay. Seasonal variations in rainfall over the two years during this study were typically consistent with historical precipitation patterns. Figure D. 2 shows the monthly total precipitation (inches) for the Padilla Bay watershed.

The main exception was during August 2016, which had unseasonably high rainfall. However this storm event was not captured through FC sampling, and so the FC samples collected during the dry season are still representative of typical seasonal conditions.

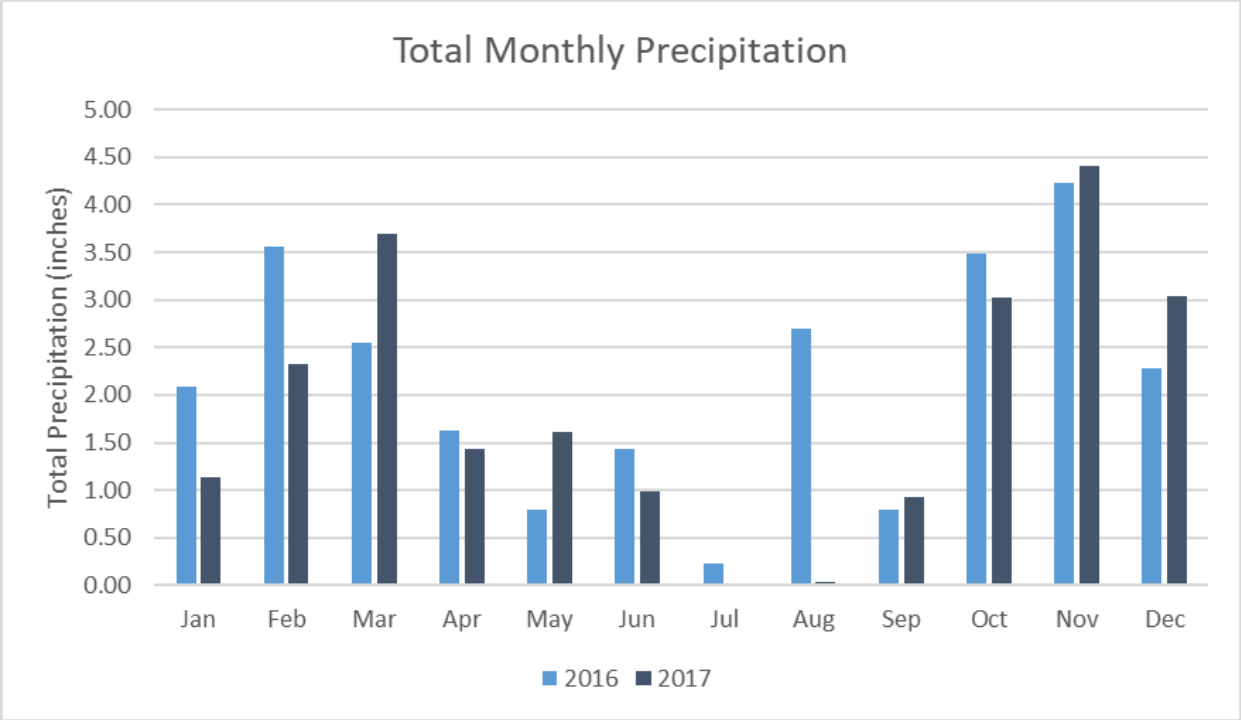


Figure D. 2 - Total monthly precipitation in Padilla Bay.

TMDLs must take into account critical conditions for steam flow, loading, and water quality parameters as part of the analysis of loading capacity. Critical conditions are represented by the combination of loading, waterbody conditions, and other environmental conditions that result in impairment and violation of water quality standards. Following EPA guidance, critical conditions for an individual TMDL typically depend on applicable water quality standards, characteristics of the observed impairments, source type and behavior, pollutant, and waterbody type.

Bacteria concentrations and loads vary seasonally throughout the Padilla Bay watershed. The critical conditions for this study refer to the season of the year with the poorest water quality, or the critical season.

The critical season for each site (Table D. 1) was ultimately determined through the Statistical Rollback analysis, based on the season that required the greatest reduction in FC to meet water quality standards. For the majority of sites, the greatest reductions occurred during the wet season. Typically, critical seasons for nonpoint sources occur during high-rainfall periods, particularly during the start of a rainfall event when bacteria are “flushed” from surface soils into the streams (Ahmed and Rountry, 2004).

Most sites in the Padilla Bay watershed had a critical season during the wet season due to precipitation and runoff. Some sites did not have enough samples collected during the dry season due to low flow, so an annual critical season was assigned to them (NN2.8, NN2.3). Chapter 2 includes a map that shows the spatial distribution of sites and their corresponding critical season.

Table D. 1 - Summary table of critical seasons.

Site	Critical Season	Reach Code
JL11.25NO	Wet	17110002000523
JL11.2	Wet	17110002000523
JL10.2	Wet	17110002000523
JL9.0	Wet	17110002000523
JL8.9	Wet	17110002001749
JL7.9	Dry	17110002001748
JL4.7	Wet	17110002000031
JL2.7	Wet	17110002000031
JL0.7	Dry	17110002000031
NN2.8	Annual	17110002000314
NN2.3	Annual	17110002000314
NN1.8	Wet	17110002000314
NN1.0	Wet	17110002000314
BI8.2	Dry	17110002000720
BI6.2	Wet	17110002001375
BI4.0	Wet	17110002001367
BI2.8	Wet	17110002000331
LI1.9	Wet	17110002000687

Despite each site being assigned a critical season based on the rollback analysis, some sites show stronger seasonal differences in FC levels than others. Recognizing this will be useful when targeting seasonal and annual sources of FC during implementation work.

Figure D.3 shows total daily precipitation throughout the entire study period (lines) and precipitation during sample dates (points). Sampling generally occurred during periods with low precipitation.

One event (11/15/16) qualified as a storm (> 0.3 inches of rain) and two other high precipitation events (3/1/17 and 10/26/16) were sampled, as represented by the arrows in Figure D.3. Sample results from these high precipitation events are in the "Eastern Padilla Bay

Tributaries Fecal Coliform Bacteria Total Maximum Daily Load Study: Water Quality Study Findings[30]"

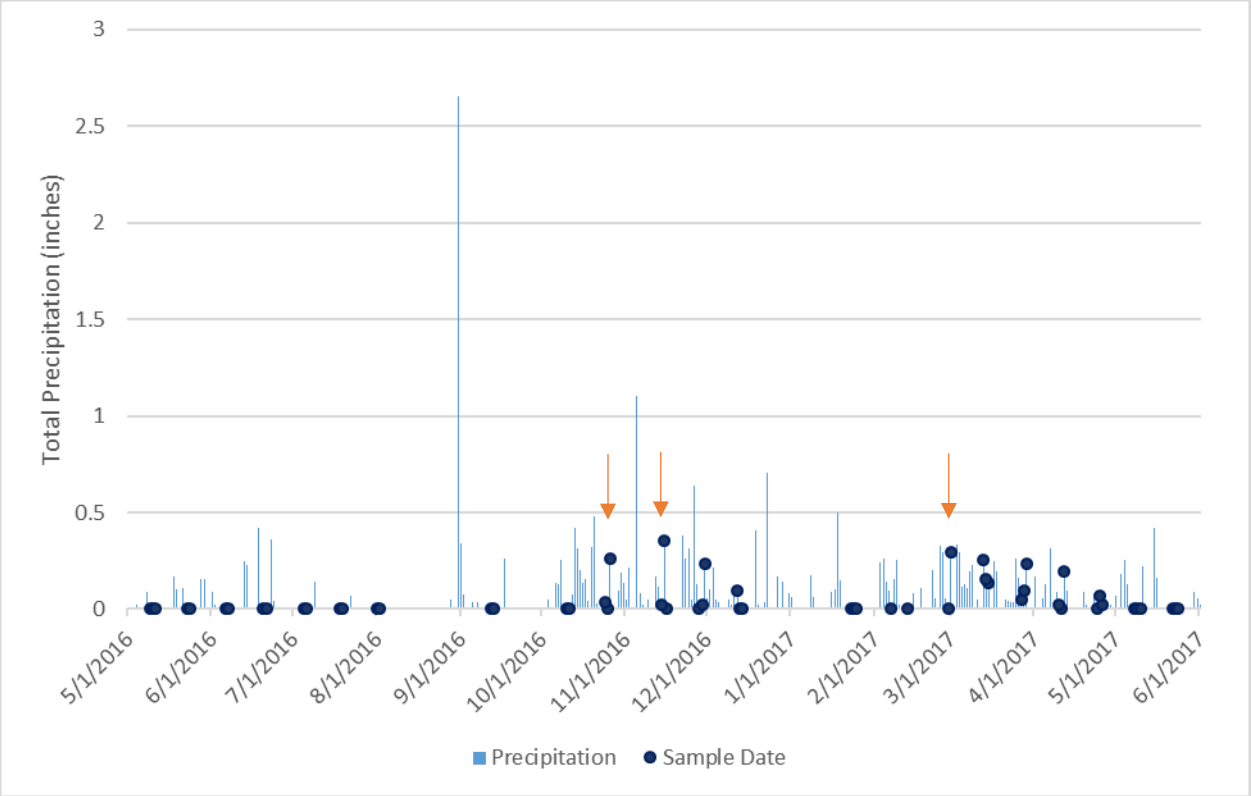


Figure D.3 - Daily rainfall accumulation during study period. Points mark sampling dates. Arrows mark high precipitation events that coincided with sampling dates (10/26/16, 11/15/16, and 3/1/17).

[30] https://fortress.wa.gov/ecy/publications/documents/2003001.pdf

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Appendix E: TMDL Analysis

The following sections provide a summary of the calculation methods of Loading Capacity and the Waste Load allocations. Additional information can be found in The Eastern Padilla Bay Tributaries Fecal Coliform Bacteria Total Maximum Daily Load: Water Quality Study Findings[31] (McCarthy, 2020) technical report.

Loading Capacity

Loading capacities were calculated as either daily loads for both the wet and dry season to inform when FC sources are violating criteria or as an annual load when limited data exists. The critical season for each site is based on the largest seasonal reduction needed to meet water quality criteria.

In addition to estimating loading capacities, FC reductions were estimated to provide a more practical basis for identifying trends and implementing restoration activities. FC reduction targets were calculated based on the statistical rollback analysis (Ott, 1997). The rollback method compares monitoring data to water quality standards (WQS) and calculates the amount of pollutant to be reduced, or "rolled-back" to meet the more restrictive criteria. Sites that require aggressive reductions in FC sources will have a high FC percentage reduction value, while sites with minor problems will have lower FC percentage reduction values. Sites representing reaches or tributaries currently meeting WQS have a minimal reduction needed (<10%). For this analysis, the statistical threshold value (STV or 90th percentile value) is more stringent. The target loads are calculated based on reducing the whole FC distribution to meet criteria. Therefore, target geometric mean values may be lower than water quality criteria (see Appendix F for graphs that demonstrate this). These percent reductions are useful to help guide restoration activities.

The values in Tables D.1 and D.2 were estimated based on the following methods:

- **Loading Capacity** (billion cfu/day): estimated using geometric mean criterion (100 cfu/100 mL) and average seasonal flow.
- **STV (statistical threshold value) Target Load** (billion cfu/day): estimated using 90th percentile criterion value (200 cfu/100 mL) and average seasonal flow.
- **Geometric Mean Target Load** (billion cfu/day): estimated using target load as determined through statistical rollback analysis and average seasonal flow.
- **Existing STV (statistical threshold value) Load** (billion cfu/day): estimated using existing 90th percentile bacteria concentration and average seasonal flow.
- **Individual FC Reductions** (billion cfu/day and percent reduction): estimated FC reduction from statistical rollback analysis needed to meet STV target load allocation.

[31] https://fortress.wa.gov/ecy/publications/SummaryPages/2003001.html

- **Progressive FC Reductions** (billion cfu/day and percent reduction): if FC reductions occur upstream and meet water quality criteria, the amount of FC reduction still needed to achieve compliance.

This TMDL established a series of progressive FC reductions needed to meet water quality criteria, as reductions are achieved upstream. FC reductions were calculated using the following steps:

1. Estimate the current FC load at each site during the wet or dry season (based on current 90^{th} percentile FC value and average seasonal flow).
2. Calculate the FC reductions as both a percentage and load estimate needed to meet WQS.
    a. Begin with the furthest upstream site.
    b. Calculate the adjusted FC reduction needed (in both load and percentage) for the following site moving downstream, if the load reduction is achieved upstream. Continue this method through the furthest downstream freshwater site.
    c. As load reductions occur upstream, further downstream sites are expected to require either less or no reduction to meet WQS.
    d. If no reductions occur upstream, then the values in the parentheses indicate the needed reductions to achieve WQS.

Individual reductions show how much bacteria levels need to be reduced when upstream improvements have not yet occurred. Progressive reductions are the amount of reduction needed if WQS are achieved upstream.

Not enough samples allowed for dry season load allocations for most of the No Name Slough sites (NN1.8, NN2.3, NN2.8) and so annual capacities were estimated for these locations. This method highlights the effects that reducing pollution sources at upstream sites will have on improving water quality conditions downstream. These estimates assume that bacteria reductions are occurring upstream, and so fewer reductions will be required downstream to achieve compliance with freshwater quality standards. Chapter 3 provides a discussion of these results. This information will be used to guide an adaptive management strategy and implementation activities where efforts will be targeting upstream sources to benefit downstream water quality conditions.

Table E.1- Daily loading capacities during the wet season. Shown in the table are current loads and the bacteria reductions needed. Segment-based progressive reductions assume that bacteria loads are reduced upstream. If no reductions upstream occur, then the individual reductions are needed.

Site	Loading Capacity [1] (billion cfu/day)	Estimated Geometric Mean Target Load [2] (billion cfu/day)	Estimated STV Target Load [3] (billion cfu/day)	Existing STV Load [2] (billion cfu/day)	FC Reductions [2]	
					Individual Reductions	Progressive Reductions
Joe Leary Slough						
JL11.25NO	16.5	4.6	32.9	112.6	79.7 (71%)	79.7 (71%)
JL11.2	15.3	4.6	30.7	108.6	78 (72%)	0.0* (<10%)
JL10.2	16.0	8.0	32.1	126.1	94.0 (75%)	14.4 (11%)
JL9.0	26.1	13.5	52.1	133.8	81.6 (61%)	67.3 (50%)
JL7.9	59.2	43.0	118.3	164.9	46.5 (28%)	0.0* (<10%)
JL4.7	121.9	73.5	243.8	508.2	264.4 (52%)	197.1 (39%)
JL2.7	131.0	104.9	262.1	360.2	98.1 (27%)	0.0* (<10%)
JL0.7	197.4	172.8	394.8	457.9	63.2 (14%)	0.0* (<10%)
No Name Slough						
NN2.8	5.3	2.7	10.6	18.6	8.1 (43%)	8.1 (43%)
NN2.3	6.4	2.8	12.7	57.1	44.3 (78%)	36.2 (64%)
NN1.8	7.2	3.5	14.4	54.4	40.0 (74%)	3.8 (7%)
NN1.0	22.1	6.9	44.3	146.2	101.9 (70%)	98.2 (67%)
Big Indian Slough						
BI8.2	4.2	1.8	8.4	7.1	0.0* (<10%)	0.0* (<10%)
BI6.2	15.1	3.4	30.2	82.1	51.9 (63%)	51.9 (63%)
BI4.0	49.4	24.1	98.7	106.0	7.3 (<10%)	0.0* (<10%)
BI2.8	75.9	41.7	151.7	196.4	44.6 (23%)	0.0* (<10%)
Little Indian Slough						
LI1.9	1.8	0.6	3.6	23.0	19.4 (85%)	19.4 (85%)

[1] based on geometric mean criterion of 100 cfu/100 mL; [2] based on target geometric mean; [3] based on 90th percentile of 200 cfu/100 mL; *0.0 (<10%) indicates minimal reduction needed.

Table E.2 - Daily loading capacities during the dry season. Shown in the table are current loads and the bacteria reductions needed. Segment-based progressive reductions assume that bacteria loads are reduced upstream. If no reductions upstream occur, then the individual reductions are needed.

Site	Loading Capacity (billion cfu/day)	Estimated Geometric Mean Target Load (billion cfu/day)	Estimated STV Target Load (billion cfu/day)	Existing STV Load (billion cfu/day)	FC Reductions	
					Individual Reductions	Progressive Reductions
Joe Leary Slough						
JL11.25NO	9.3	2.6	18.63	15.05	0.0* (<10%)	0.0* (<10%)
JL11.2	3.9	0.8	7.77	12.95	5.2 (40%)	5.2 (40%)
JL10.2	5.0	4.3	10.06	30.11	20.1 (67%)	14.9 (49%)
JL9.0	12.6	6.6	25.19	39.55	14.4 (36%)	0.0* (<10%)
JL7.9	14.8	9.4	29.52	62.48	33 (53%)	18.1 (29%)
JL4.7	32.3	26.2	64.56	53.88	0.0* (<10%)	0.0* (<10%)
JL2.7	52.2	50.5	104.46	113.46	9 (8%)	0.0* (<10%)
JL0.7	81.0	64.0	161.99	322.94	161 (50%)	142.9 (44%)
No Name Slough						
NN2.8						
NN2.3						
NN1.8						
NN1.0	0.7	0.3	1.44	2.00	0.6 (28%)	0.6 (28%)
Big Indian Slough						
BI8.2	0.6	0.1	1.14	3.35	2.2 (66%)	2.2 (66%)
BI6.2	4.3	0.9	8.51	5.35	0.0* (<10%)	0.0* (<10%)
BI4.0	7.5	1.4	15.00	2.99	0.0* (<10%)	0.0* (<10%)
BI2.8	16.4	9.4	32.81	27.43	0.0* (<10%)	0.0* (<10%)
Little Indian Slough						
LI1.9	0.2	0.2	0.45	1.44	1.0 (69%)	1.0 (69%)

[1] based on geometric mean criterion of 100 cfu/100 mL; [2] based on target geometric mean; [3] based on 90th percentile of 200 cfu/100 mL; *0.0 (<10%) indicates minimal reduction needed

Wasteload Allocations

During the writing the TMDL and Water Quality Improvement plan, the MS4 areas and boundaries were refined based on communication with the MS4 permittees (Skagit County, City of Burlington) and Secondary Permittees (Port of Skagit, Drainage District 19).

- The MS4 area related to the City of Burlington was reduced (originally 756 acres to 377.8 acres) based on MS4 infrastructure maps which documented water routed out of the Padilla Bay watershed.
- The MS4 area allocated to Skagit County (4,497 acres) did not include the Secondary permittee information related to the Port of Skagit and Drainage District 19. The boundaries shown is Figure E.1 are based on the estimated areas allocated to each permittee. The updated areas have been updated in Table E.-3. These areas may continue to be refined based on ongoing mapping efforts to document MS4 infrastructure.

WLAs are developed for point sources within a watershed. Permit holders within the study area will receive WLAs based upon the WQS and their estimated current loadings to Padilla Bay. Without extensive runoff and stormwater data available, Ecology used a land-use-based approach, or the Simple Method, to estimate the relative contribution of point sources to bacteria loads in stormwater runoff in the study area (Schueler, 1987). This method uses estimates of drainage area, impervious cover, stormwater runoff bacteria concentrations, and annual precipitation.

Table E.3 summarizes the number of permits by permit category. Figure E.1 shows a map of the distribution of these permits and MS4 permitted areas.

Table E.3- NPDES and State Waste Discharger permittees in the Padilla Bay watershed.

Permit Type	Category	Permit Count
MS4	Skagit County	1
MS4	Port of Skagit	1
MS4	Drainage District 19	1
MS4	City of Burlington	1
MS4	WSDOT	1
General	Sand & Gravel	4
General	Construction SW	24
General	Industrial SW	26
Individual	Industrial NPDES	2

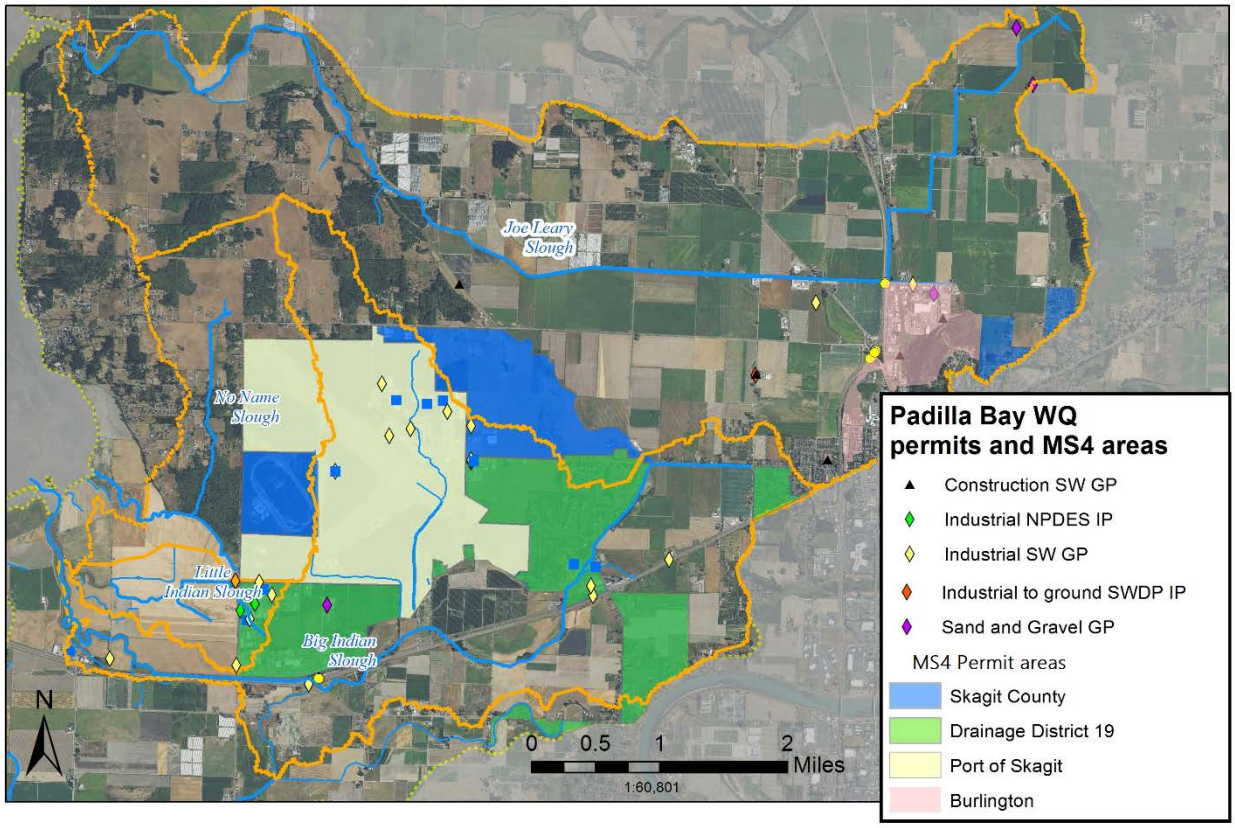

Figure E.1 - Map of Municipal Stormwater Permit areas and locations of water quality permits.

MS4 Permits

Both Skagit County and the City of Burlington have NPDES Phase II municipal separate storm sewer system (MS4) permits within the study area. The Port of Skagit and Drainage District 19 are also included as Secondary Permittees within the TMDL area.

The area that these permits cover was calculated using a spatial dataset for municipal stormwater permit area boundaries (Ecology, 2017). The percentages used for impervious cover specific to each land type (Table I-1) were determined based on values from other TMDL studies and reports (Center for Watershed Protection, 2005; Joy, 2004; Lee, 2008; Svrjcek, 2006). The impervious fraction for each permit area was then calculated by taking the weighted average of land use cover and impervious surfaces for each permit area (Department of Revenue, 2010).

The amount of impervious cover strongly correlates with water quality; the more impervious cover, the higher the bacteria levels (PSAT, 2005). Impervious surfaces such as roads, roof tops, and parking lots accumulate contaminants and prevent water from infiltrating as would occur on vegetated grounds. Due to the rush of water off these surfaces, stormwater can carry much of the bacteria directly into a stream, particularly during the wet season.

Table E.4 - Land use category impervious cover within each permit area.

Land Use Category	Impervious Cover %
Agriculture	30
Commercial/Manufacturing	87
Forests/Parks	20
Residential	40
Transportation	80

The amount of impervious area within each permit category is displayed in Table E.5.

Table E.5 - MS4 permit values.

Permit	Category	Permit Holder	Area (acres)	Impervious Fraction	Impervious Area
MS4	County	Skagit County	1093.1	0.62	677.7
MS4	Secondary	Drainage District 19	4405.0	0.43	1865.77
MS4	Secondary	Port of Skagit	1944.3	0.62	1205.5
MS4	City	City of Burlington	377.8	0.63	238.01

WSDOT Permits

WSDOT permits cover highway systems running through the study area, and these include Interstate Highway 5 (I-5), Washington State Route 11, State Route 20, and State Route 536. This study followed the approach of previous TMDL studies that estimated road cover depending on standard road widths and impervious fraction for major WSDOT roads (Svrjcek, 2006; Lee, 2008). Road width was estimated based on the number of lanes and assuming typical road widths (12 feet per lane). The road width for the different highways accounted for shoulders and right of way. Aerial photography was used to confirm this approach, by reviewing number of lanes, presence of shoulder area and right of way, and measuring road width distance.

Table E.6 - WSDOT road area and impervious fraction.

Road	Area (acre)	Impervious Fraction
I-5	44	0.80
Route 11	12	0.80
Route 20	66	0.80
Route 536	11	0.80

General Permits

Major general permits in the study area include sand and gravel, construction stormwater, and industrial stormwater. For this TMDL, the following process was used to estimate WLAs for general permits:

1. Combine permit holders by categories and estimate area and impervious cover through GIS spatial analysis, land use data, and permit information.
2. Estimate relative seasonal bacteria loading for permit category to achieve compliance with Water Quality Standards using the Simple Method.
3. Assign WLAs to stormwater permit holders based on permit categories.

The area covered by each individual general permit was estimated from reviewing current and historical water quality permits from Ecology's Water Quality Permitting and Reporting Information System (PARIS) database. Impervious cover was estimated by viewing sites using aerial photographs, spatial datasets of impervious area and land use cover, and impervious cover fractions from other studies (Svrjcek, 2006; Lee, 2008).

Table E.7- General permit area and impervious fraction.

Permit	Category	Count	Area (acres)	Impervious Fraction
General	Sand & Gravel	2	93	0.10
General	Construction SW	20	150	0.70
General	Industrial SW	21	1,205	0.90

Precipitation

Precipitation during the wet and dry seasons was estimated based on 2016-2017 precipitation data from the National Estuarine Research Reserve System (NERRS). The average of total precipitation during the wet season (October – April) and dry season (May – September) for both years was used.

Table E.8- Total precipitation during 2016-2017.

Season	2016 Total Precip (in)	2017 Total Precip (in)	Average (in)
Wet Season	19.9	19.1	19.5
Dry Season	6.0	3.6	4.8

Calculating Runoff

The Simple Method uses available data and assumptions to approximate the seasonal number of bacteria discharged in stormwater from different land use areas (Figure E.2).

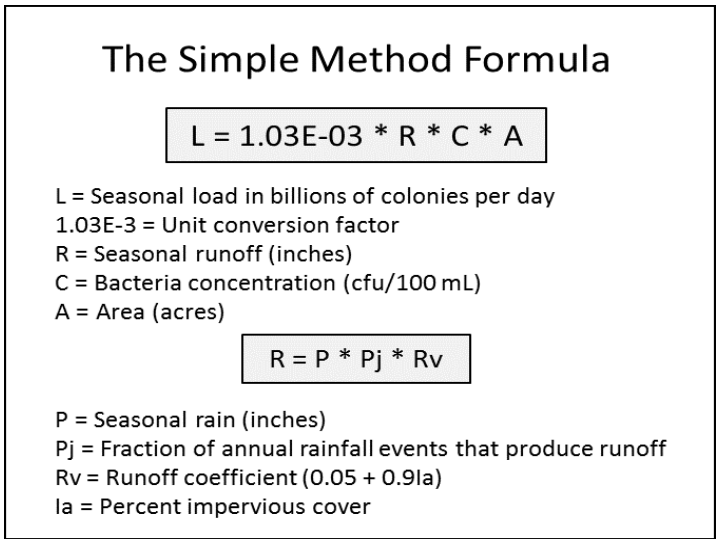

Figure E.2 - The Simple Method Formula.

The formula requires certain constants and subbasin-specific values (Table E.9):

- Area was estimated based on GIS spatial data, land cover, and permit information.
- The bacteria concentration value was set to achieve compliance with Washington State Water Quality Standards (100 cfu/100 mL).
- The impervious fraction (Ia) was determined for each permit area and is used to calculate the runoff coefficient.
- A constant of 0.85 was used for the fraction of annual rainfall events that produce runoff, consistent with other TMDL studies that have used the Simple Method (Svrjcek, 2006; Lee, 2008).
- Seasonal rain was based on average of total precipitation during the wet and dry season and was obtained from the National Estuarine Research Reserve System (NERRS) during 2016-2017.
- Seasonal runoff for each permit area was estimated based on precipitation, fraction of annual rainfall events that produce runoff (Pj), and a runoff coefficient (Rv) using the following formula:

$$R = P * Pj * Rv$$

P = Seasonal rain (inches)
Pj= Fraction of annual rainfall event that produce runoff
Rv = Runoff coefficient (0.05 + 0.9Ia)
Ia= Percent impervious cover
R = Seasonal Runoff (inches)

Estimating Wasteload Allocations using the Simple Method

The Simple Method was used to calculate WLAs based on the constants and calculated values in Table E.9. The target bacteria concentration was set at 100 cfu/100 mL to achieve compliance with the geometric mean water quality standards.

L = 1.03E-03 * R * C * A

L = Seasonal load in billions of colonies per day
1.03E-3 = Unit conversion factor
R = Seasonal runoff (inches)
C = Bacteria concentration (cfu/100 mL)
A = Area (acres)

Table E.9- Simple Method constants and calculated values.

Permit	A	C	Ia	Pj	Wet Season Precip	Wet Season Rv	Wet Season Runoff	Dry Season Precip	Dry Season Rv	Dry Season Runoff
Skagit County	1093	100	0.62	0.85	19.47	0.61	10.06	4.76	0.61	2.46
Drainage District 19	4405	100	0.62	0.85	19.47	0.61	10.06	4.76	0.61	2.46
Port of Skagit	1944	100	0.62	0.85	19.47	0.61	10.06	4.76	0.61	2.46
City Burlington	378	100	0.63	0.85	19.47	0.62	10.21	4.76	0.62	2.50
WSDOT	107	100	0.80	0.85	19.47	0.77	12.74	4.76	0.77	3.12
GP Sand & Gravel	8	100	0.10	0.85	19.47	0.14	2.32	4.76	0.14	0.57
GP Construction SW	155	100	0.64	0.85	19.47	0.62	10.29	4.76	0.62	2.51
GP Industrial SW	1197	100	0.87	0.85	19.47	0.83	13.79	4.76	0.83	3.37

Wasteload allocations were calculated as both a seasonal load and averaged as a daily load.

Individual Permits

There are two individual permits that discharge into surface water within the study area, with the remainder of individual permitted facilities discharging into either groundwater or sewer systems. Based on reviewing associated permit documents using Ecology's Water Quality Permitting and Reporting Information System (PARIS), these facilities currently have no effluent requirements established for fecal coliform bacteria.

Flow data were obtained from PARIS for the two facilities draining into surface waters and was averaged by season as an average flow (Table E.10). Seasonal wasteload allocations were calculated using a bacteria concentration value of 100 cfu/100 mL (consistent with MS4 and other general permits).

Table E.10- Seasonal wasteload allocations for individual permit facilities.

Individual Permit	Dry Season Flow (cfs)	Dry Season Daily WLA (billion cfu/day)	Wet Season Flow (cfs)	Wet Season Daily WLA (billion cfu/day)	Annual Flow (cfs)	Annual WLA (billion cfu/day)
Hughes Farms	0.12	0.30	0.14	0.34	0.13	0.32
Chemtrade Sulex, Inc.	--	--	0.06	0.15	0.06	0.15

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